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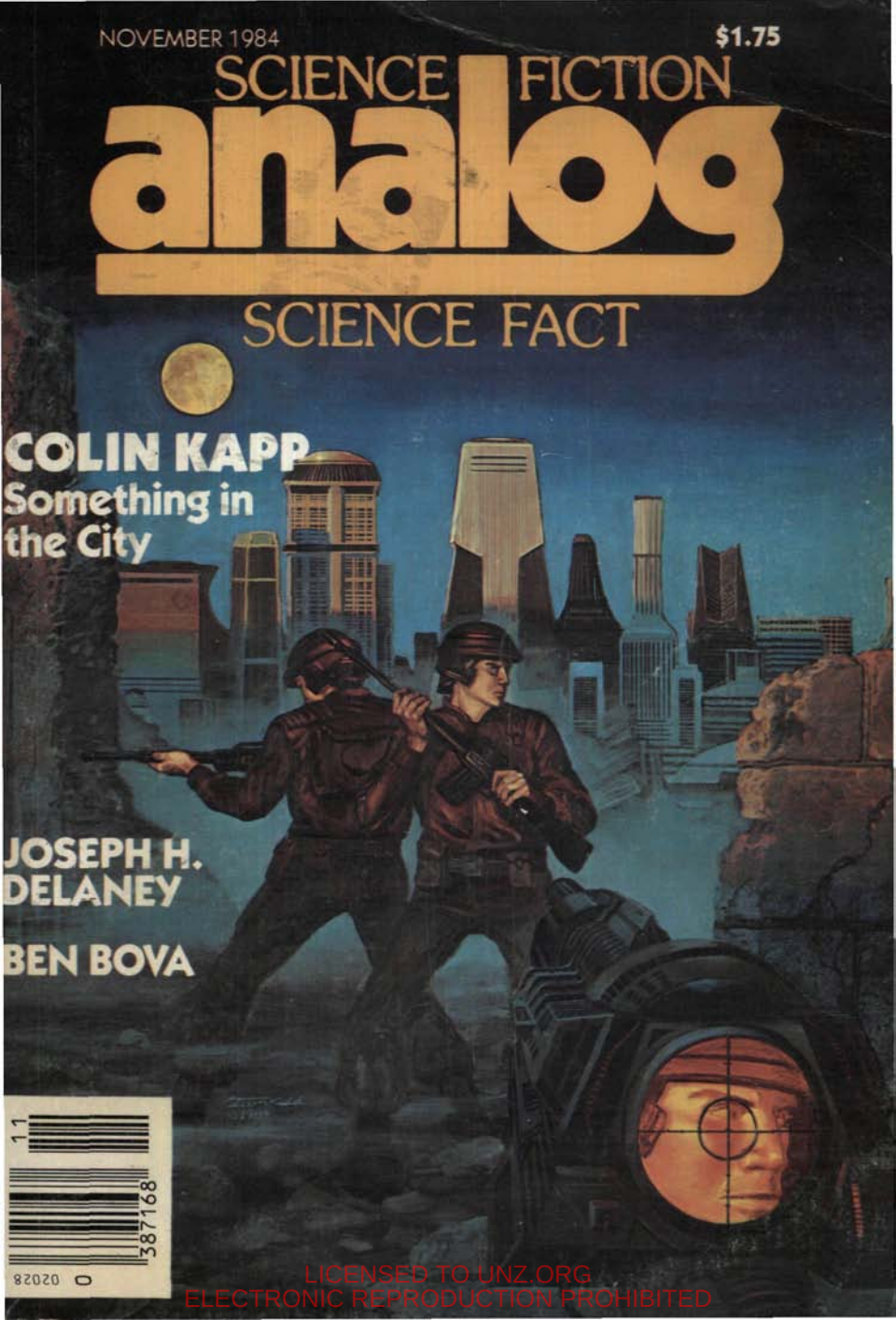

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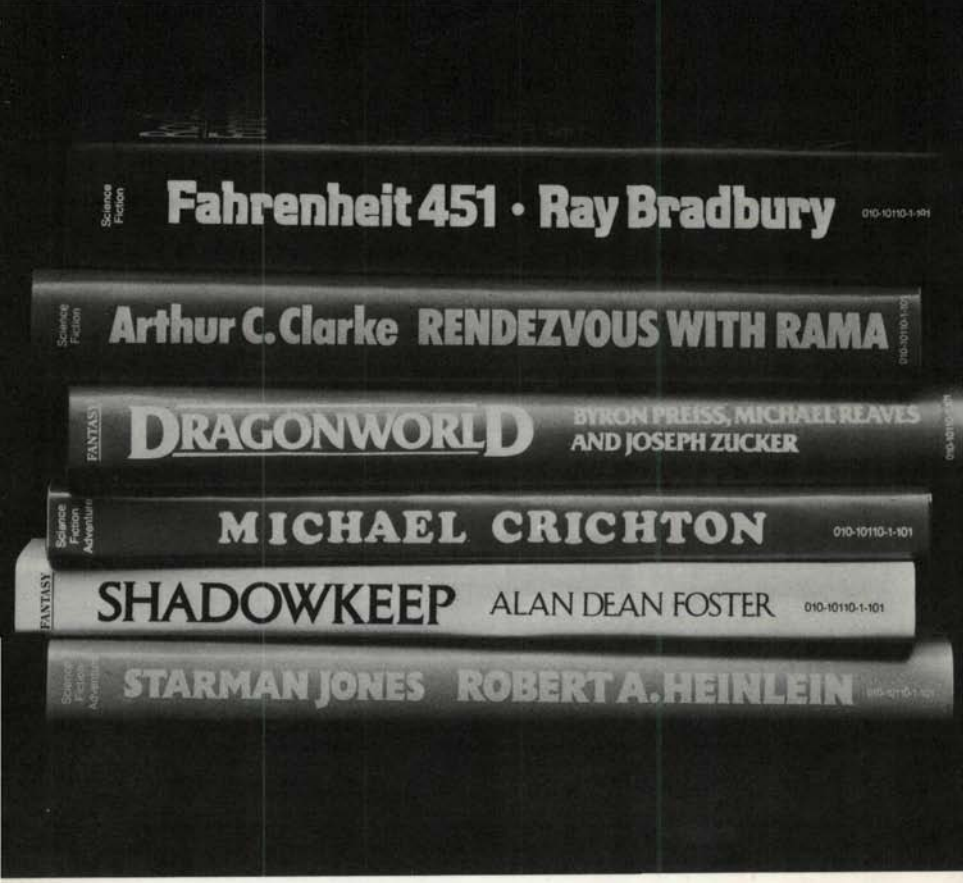

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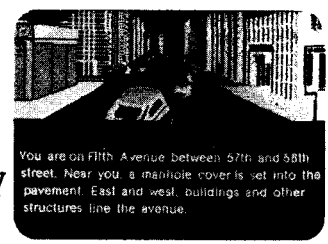
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analog

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Guest Editorial

FREEDOM FROM FEAR

Ben Bova

Shakespeare's Hamlet, brooding on the attractions of suicide over a continued life of anguish, concluded that the fear of what lies beyond death is the great deterrent to self-destruction:

> And makes us rather bear those ills we have
> Than fly to others we know not of . . .

So too, much of today's academic community, including many scholars who have spent most of their professional lives in the field of nuclear strategy, have decided they would rather "bear the ills" of our twenty-year-old policy of Mutual Assured Destruction than "fly to others we know not of": namely, the possibility of a space-based defense against nuclear attack.

Most of these academics are so firmly wedded to MAD that they view any attempt to protect ourselves against nuclear devastation as not only politically destabilizing, but morally reprehensible.

As I write this, just over a year has elapsed since President Reagan's "Star Wars" speech of 23 March 1983. The concept of placing defensive weapons in orbit, where they could blunt a nuclear missile attack, is not new to the readers of *Analog*. But it caught most of the rest of the world—including the academics—by surprise.

In a small way, I was present at the birth of this new idea. In 1965, I was

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manager of marketing for the Avco Everett Research Laboratory, where the breakthrough into truly high-power lasers was made. I helped to arrange the first Top Secret briefing in the Pentagon, where Avco's scientists revealed to the Defense Department that lasers of incredible power could now be developed. I was privy to some of the earliest studies on the possible use of laser-armed satellites to destroy attacking ballistic missiles.

In the years since then, I have written about these possibilities in novels such as *Millennium* and *Kinsman*. I have just completed a nonfiction book, *Assured Survival*, that examines the technical, military, and political implications of space-based defenses and other high-technology approaches to preventing war.

In the course of these years, I have learned two things:

1. We have at our fingertips the means to prevent nuclear war.

2. Most of the entrenched academic scientists and strategic analysts will resist any move toward this new possibility.

Indeed, their resistance is already quite evident. The Union of Concerned Scientists has denounced the "Star Wars" concept of space-based missile defense as technologically infeasible and economically ruinous. Carl Sagan, Hans Bethe, and many former science advisors to Presidents have similarly inveighed against placing weaponry in space.

Many strategic analysts have made it quite clear that they prefer MAD, in which the two superpowers each offer their own civilian populations as hostage to the good will of their adversary, to the possibilities of defense. Their tortured logic is that, by building defenses, we will so frighten the Soviets that they will launch the long-dreaded nuclear attack upon us. Defensive systems, they say, are not only impossible, immoral and expensive, but destabilizing as well.

For forty years the world has witnessed an arms race of steadily escalating, constantly more frightening, weapons of attack. The atomic bomb and the V-2 rocket have evolved into the hydrogen bomb and the ICBM with its MIRVed warheads. The Cold War has been a natural consequence of this horrifying technology. With weapons that are too terrible to use, neither the United States nor Soviet Russia has dared to attack one another. But because each possesses such powerful weapons, neither one will back down and accommodate its adversary. The result, a stalemate of terror.

Now the technological drive is toward a new kind of weaponry, the weapons of defense: very high-power lasers and other energy weapons of pinpoint accuracy, directed by very smart computers, are beginning to give the defense its chance to catch up with the offense —after forty years.

But after two generations of equating weaponry with mass destruction, most of the academic community automatically react adversely to any talk of new weapons. The media depend on "knowledgeable" academics to inform the world of what is possible and impossible in the world of science. The media go to these same academics to

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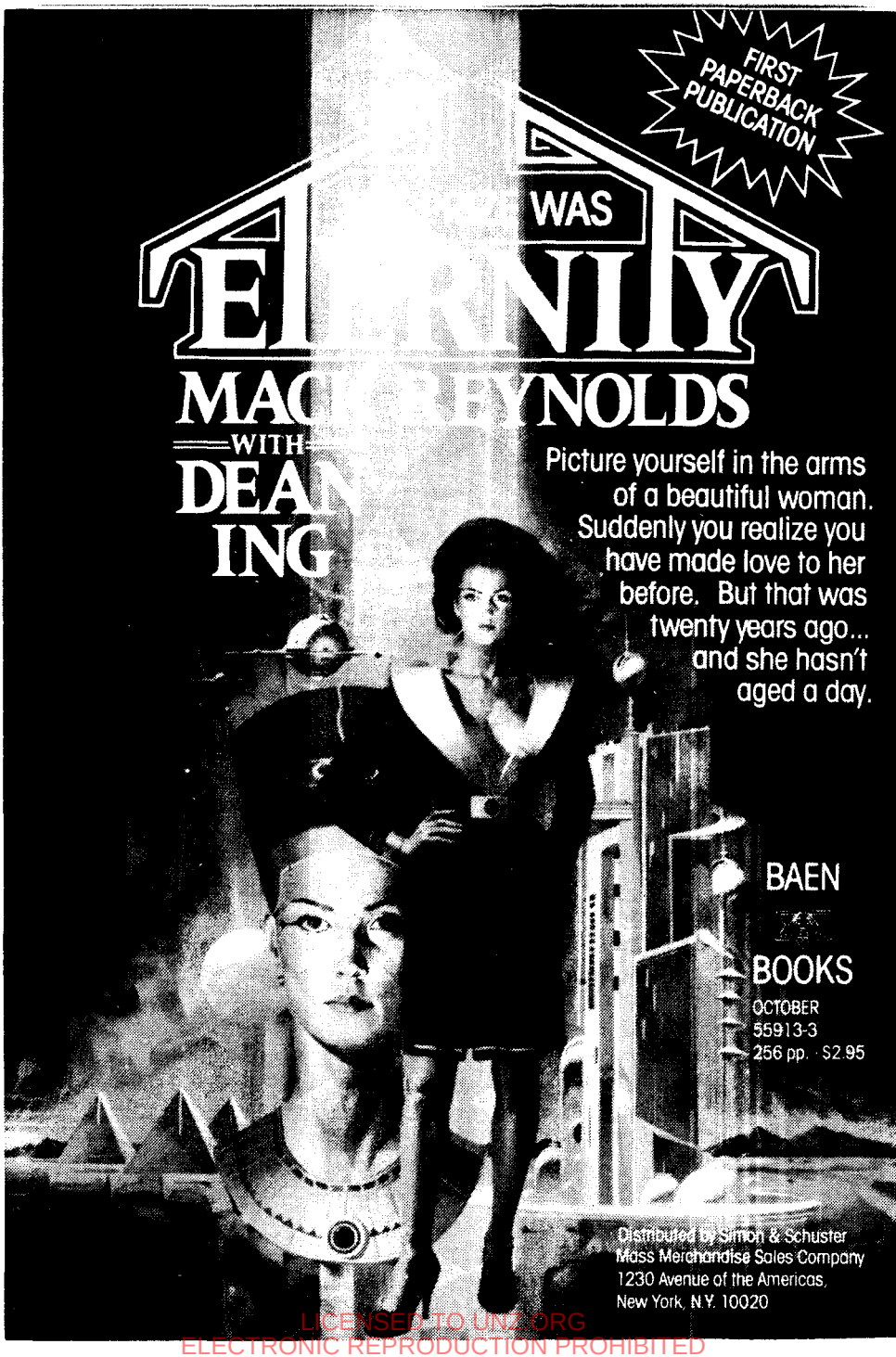
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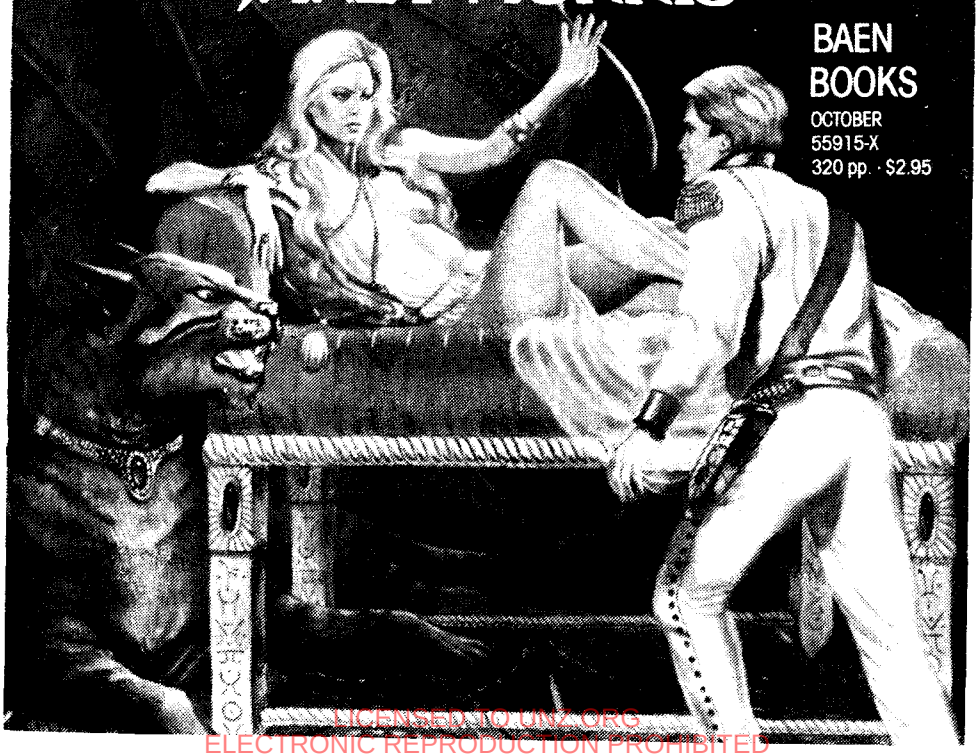

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check on technological pronouncement coming out of the Department of Defense and other branches of government.

Most of these academics are poorly informed about the latest work in weaponry, in large part because such work is generally classified secret by the Pentagon. And their bias, fed by memories of Hiroshima and Vietnam, is against weapons development. Hence their resistance to weapons that can defend the world against nuclear missiles and more conventional machines of destruction.

The readers of *Analog* certainly are better informed than most Americans about the feasibility of high-tech weapons. Networks of satellites armed with lasers or other advanced defensive weapons will work, and they will be deployed in the decade of the 1990s. Even if the system costs a trillion dollars, no American government would be able to resist the pressure to defend this nation against missile attack—once the American public becomes convinced that such a system will work.

Will the deployment of defensive satellites trigger the nuclear holocaust we all want to avoid? Not likely. It will take many years, perhaps a decade, to establish an effective system. In that time, the Russians will either negotiate us out of it, build their own defensive system to keep abreast of us, or perhaps even join us in creating a global defensive system that will protect every nation on Earth against attack by any nation.

That last possibility seems as far-fetched as flying to the Moon seemed in 1944. But it is equally inevitable. For, just as the technologies of offensive

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weaponry led to the Cold War, the new technologies of defensive weaponry will eventually lead the politicians to create an international system where nuclear war—perhaps all kinds of war—will be sternly repressed by a true multinational peacekeeping force.

Perhaps we will have to come to the very brink of the nuclear abyss before we draw back and begin to place our reliance on defenses and new political arrangements that will make war impossible. Perhaps the mushrooms will have to bloom again, and it will take a nuclear engagement of some sort to make the nations realize that an international peacekeeping force is necessary.

But it will happen. And it will happen, most likely, in this way:

Both the United States and the Soviet Union will test defensive, anti-missile weapons in orbit before the decade of the 1980s is over. Despite the wailings of those who would rather live under the terror of nuclear annihilation, both superpowers will begin to deploy defensive systems in orbit during the 1990s. This will be a time of very high international tensions, as the two superpowers and their allies jockey for advantage, both in orbital space and at the conference table. A new arms race will have begun: a *defensive* arms race.

By the turn of the century, there may well be two separate networks of defensive satellites in orbit. Neither defensive system will be foolproof; the offense will always be able to get a few missiles through to their targets. But a

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few is not enough. The defensive systems in orbit will make it virtually impossible for either side to launch a nuclear attack upon the other. Slowly, but with the certainty of time, the nuclear-tipped missiles will become obsolete.

In time, the peoples of the world will become accustomed to having guardians orbiting overhead, preventing nuclear missile attack. The governments of the world will start to cooperate more, as the terror of nuclear annihilation recedes. Eventually (and this may be a *long* time from now) the two orbital defensive systems will be merged into one, as even the two superpowers learn how to trust one another.

In 1941, as war raged in Europe and Asia and was soon to engulf the United States, President Franklin D. Roosevelt enunciated the Four Freedoms, which he wished to see promulgated everywhere in the world. Among them was *Freedom from Fear*. In today's world, where the nations spend more than $600 billion per year on armaments, the fear of war and annihilation is stronger than ever within us. But we can create a world without war, we can gain our freedom from fear, if we are wise enough to use the tools that technology is forging for us.

The ancient Greeks worshipped two war deities: Ares (the Roman Mars) was the aggressive, bloodthirsty god of violence who enjoyed nothing better than to see men fighting and killing each other. Athena, who sprang full-grown from the brow of Zeus bearing shield and spear, was originally a battle goddess. But as time evolved Athena became the gray-eyed goddess of wisdom, of learning, of civilization and democracy. Her symbol was the owl, and ancient Athens became her special city. She remained a warrior goddess, but she represented to the Greeks the craft of defensive war, of strategy and planning, of careful preparations that can minimize bloodshed.

It is time that we, with this generation of awesome weapons in our hands, turn away from bloody Ares and his battle-lust and turn toward wise Athena. It is time that we begin the long, difficult road toward a world of peace, a world which is freed from the crushing burden of armaments, a world where orbital guardians make it impossible for any nation to attack its neighbors, a world in which our children and our children's children will be free at last of the fear of war.

We have at our fingertips the tools to fulfill the ancient prophecy of Isaiah:

And they shall beat their swords into plowshares, and their spears into pruning hooks; nation shall not lift up sword against nation, neither shall they learn war anymore. ■

● Some problems do not get solved, they only get older.

Dr. Chaim Weizmann

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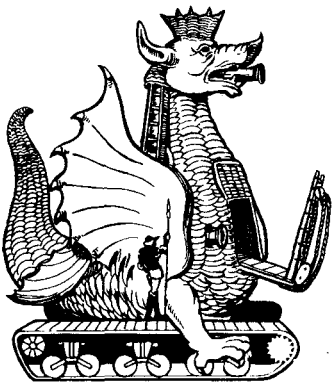

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SOMETHING IN THE CITY

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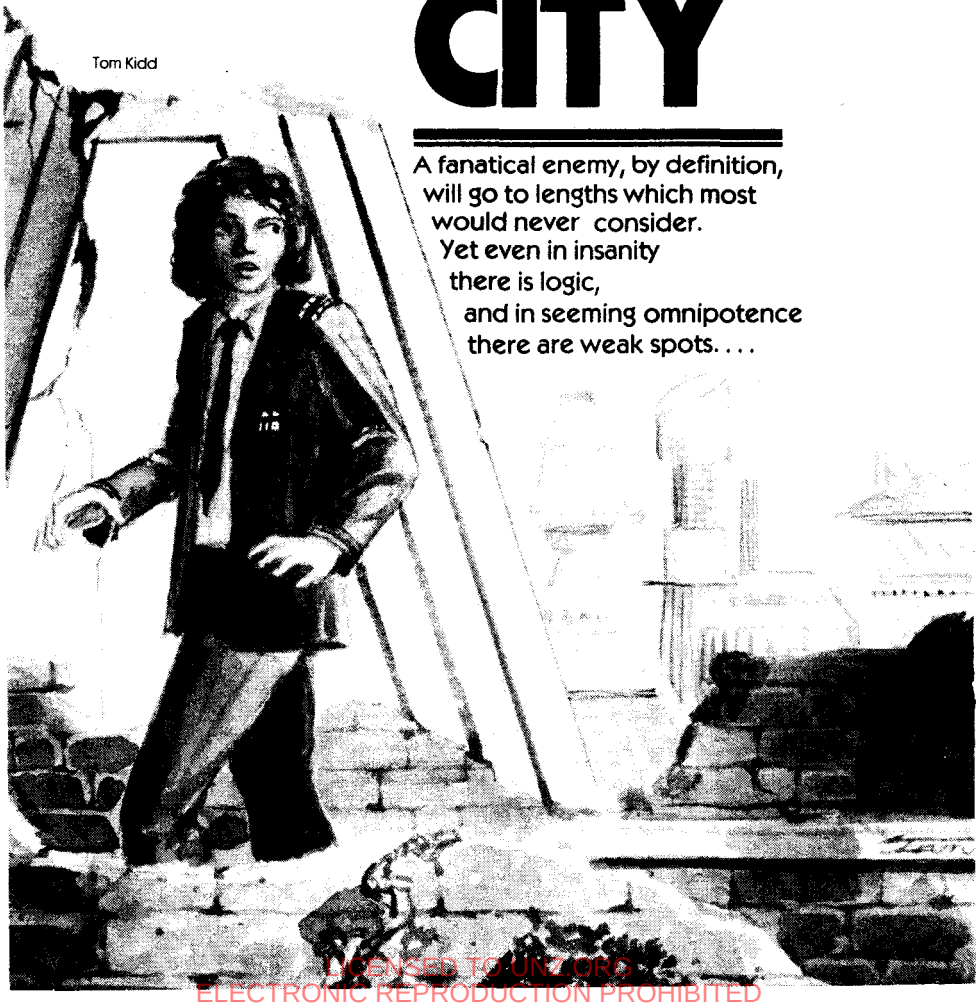

A fanatical enemy, by definition,
will go to lengths which most
would never consider.
Yet even in insanity
there is logic,
and in seeming omnipotence
there are weak spots. . . .

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Bowman

"Early!"

As she descended the steps from the large military transport helicopter, the first thing Lieutenant Early Annandale saw was a friendly major earnestly trying to attract her attention by waving a clipboard. He hurried to wait for her by the front of the steps.

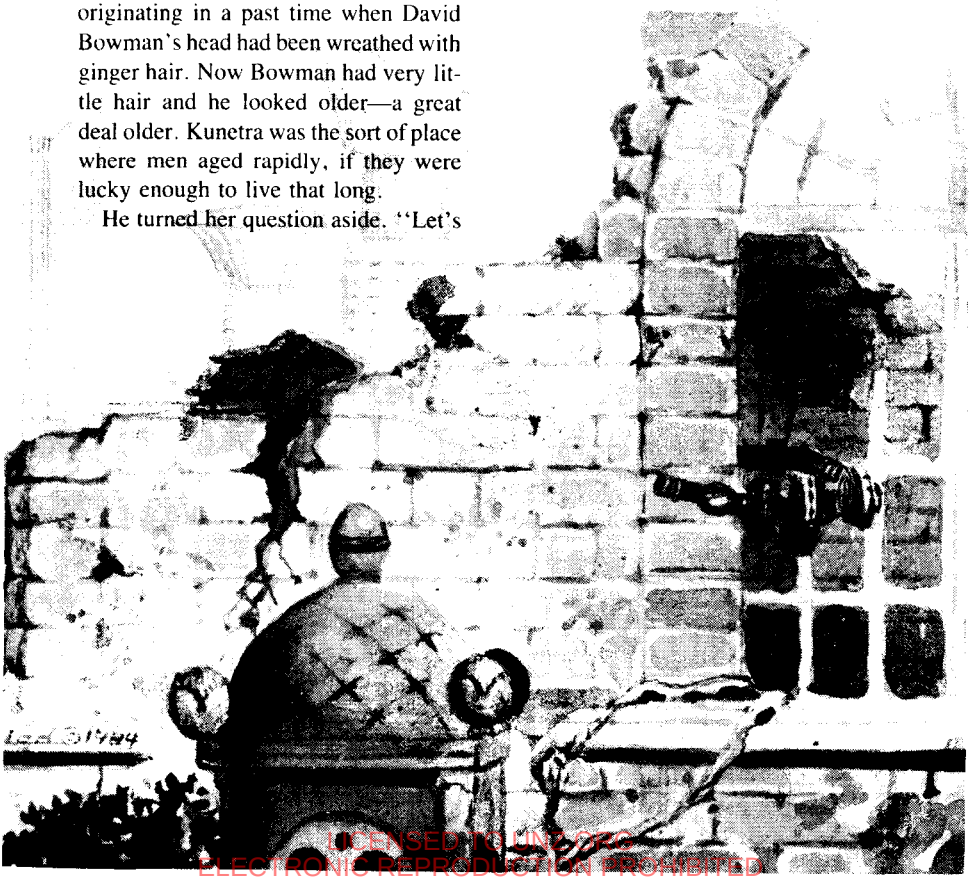
"Early. I figured it had to be you. There can't be two lieutenants of the same name on WarTech's staff."

"Sandy!" The reunion was both a pleasure and a surprise and both emotions were mirrored in her pert face. "What are you doing in Kunetra?"

The name Sandy was a nickname, originating in a past time when David Bowman's head had been wreathed with ginger hair. Now Bowman had very little hair and he looked older—a great deal older. Kunetra was the sort of place where men aged rapidly, if they were lucky enough to live that long.

He turned her question aside. "Let's have a look at you, Early." He stepped back to gaze appreciatively at her trim figure which, if anything, was enhanced by the cut of the smart green uniform she wore. "My, you're a sight for sore eyes!" Then he noticed the Tactical Intelligence flashes on her shoulders and the joy faded from his face, to become replaced by his latterly habitual look of anxiety and doubt. "You still working for *him*?"

"Colonel Maidment, yes." She was laughing, but only slightly, at the concern in Bowman's eyes. Colonel Maidment, head of Tactical Intelligence, was a particular kind of legend, and not one



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which suited everyone's palate. In ruthlessly pursuing his duties, Maidment had made a great many enemies, not a few of them on his own side of the war.

Bowman shook his head sadly. "I don't know why you do it, Early. Honest to God I don't."

"There are reasons," said Early kindly.

"Reasons to work for that bastard?"

"And as you know," there was the faintest touch of reproof in her voice, "some of those reasons can never be told."

He shrugged his shoulders, defeated, then turned back to the matters at hand.

"Look, Early," he indicated the giant helicopter now opening its cargo hatches, "I have to supervise the unloading of this lot. All technical stores. Most of it yours, I shouldn't wonder. I'll have a driver take you to the mess. I'll join you there as soon as I can. But listen to me carefully. Stay inside the mess where the driver leaves you, and don't do anything damn stupid like walking out to admire the view. There's a lot needs explaining before you walk out alone in Kunetra."

"Sandy, I . . ." She started to protest but he stopped her with an emphatic wave of his hand.

"Just do it, Early. Later you'll understand. My God, that bastard Maidment! Sending you to Kunetra. There's only one person I'd really like to see here, and that's Maidment himself. Brother, would I really like that!"

Bowman spoke rapidly into his handheld transceiver, and a small half-tracked vehicle detached itself from a park and ran swiftly toward them. He threw Early's personal luggage into the back, waited while she seated herself next to the driver, then signaled the half-track away with the merest nod of his head. The fact that the driver had neither asked for nor was given any hint of destination was something Early noted with only a slight lift of her eyebrows. Such was the state of affairs in Kunetra that unusual precautions to protect the lives of new arrivals had become an unspoken part of their way of life.

The driver was young, barely eighteen Early thought, and, though sweat-soaked, his uniform still had traces of newness in it. Furthermore he seemed discomfitted by the presence of a female officer, especially by such an attractive and inquisitive female officer as was his passenger. He stammered and never could decide whether to call her "Lieutenant" or "M'am" in answer to her questions. Once, in his confusion, he even called her "Sir." He had been in Kunetra barely two months, one of an emergency-draft replacement for a number of men who had been killed in the city. Already six men out of the original twelve in the draft had been killed, and a seventh had deliberately shot himself in the foot and had to be flown out for medical treatment and Court-Martial for cowardice. The way the story was related no judgements were passed. Men came and went: either they found their own exits or the exits came and found them. And all this had to be viewed against the stark fact that Kunetra was a dead city.

* * *

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Bowman's intention of joining Early rapidly was thwarted. The technical stores in the helicopter's hold had been accompanied by a Corporal Hammond, who had the look of an athlete and the intellectual air of a university professor. He was tall, wore bifocal glasses, and was obviously out of place as a non-commissioned officer. Corporal Hammond very clearly knew the value and complexity of the instruments in the cases and knew exactly how they should be handled. He patiently ordered the whole operation, apparently unmindful of the fact that Bowman considerably outranked him. Not until the whole consignment had been loaded into the WarTech air-conditioned caravans which had been set on site a few days earlier did Hammond let up—either on himself or on the sweating, cursing men who had been detailed to assist him.

Then he returned to Bowman and saluted thoughtfully. His shoulder-flashes carried the emblem of the WarTech Special Signals School, and Bowman placed him as probably a genius at electronics but one so detached from life that he had failed officer cadet training. Nonetheless, there was something about the man which made him feel vaguely uneasy. He felt reasonably certain about one thing—the fellow did not work for Maidment. Maidment, the arch-liar of the decade, always made his deceptions so immaculately credible.

"Many thanks for your cooperation, Major. Is it possible for me to get a word through to Lieutenant Early?"

"Lieutenant Annandale," corrected Bowman. He hefted the transceiver on the lanyard at his wrist and caught it expertly. "I think that can be arranged, Corporal. Do you want to speak to her?"

"No. Sir. Just a message. All the equipment is accounted for and apparently undamaged. I'll be testing and installing overnight, and the unit should be operational tomorrow morning."

"Just that? I'll tell her myself. Mind telling me what you've got up there, Corporal—if it isn't too much of a secret."

Hammond pursed his lips. "With respect, Major, I don't have the authority to discuss it. Perhaps if you ask the Lieutenant."

"Perhaps," said Major Bowman dubiously. "But I think I'd need to get up very early in the morning to get much out of our Early. If you're working all night I won't bother to fix up your billeting until tomorrow."

"That won't be necessary, Sir. One of the WarTech vans has already been equipped with accommodation for the Lieutenant and myself."

Separately or together?" The question was a joke.

Hammond smiled shyly. "Separately. As you said, Major, you'd have to get up very early in the morning in order to catch Lieutenant Early."

Rather than recall one of the half-tracks which had taken members of the unloading detail back to their quarters, Bowman decided to walk. The journey to the mess where Early had been taken was scarcely more than a mile, and Bowman, as was his mood with increasing frequency, felt in need of solitude.

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The city of Kunetra depressed him greatly and dominated both his dreams and his waking thoughts. Kunetra was dead, yet incredibly, obstinately it refused to die. It had started to possess his mind to such a degree that sometimes he had forcibly to remind himself that there was still another world outside.

The city, spilled out in its bowl of hills, had been a strategic obstacle to the advance of the Western armies striving to gain a foothold on the eastern plains. Heavily and bitterly defended by the troops of General Quador, Kunetra and its approaches had proven unassailable. Such was its determination not to fall that the stalemate had probably added at least a year to the war and at a cost calculable in millions of lives donated by both sides. To break the impasse the Western Command had finally decided to think the unthinkable. After due warning to allow the occupying forces and civilians to escape, they had detonated a neutron device low over the city. It was a very 'clean' bomb: residual radiation levels were acceptably low and the damage it had done to the fabric of the city was scarcely discernible. Yet in that dreadful moment every living thing in the city had died. Kunetra had been sterilized by neutron radiation.

General Quador, too, had been thinking the unthinkable, and with the same brand of ruthlessness and perversity of logic which had made his a name to be feared on three continents. Knowing he could no longer hold Kunetra he determined to make it a costly and regrettable prize, and one which would severely damage the Western cause in the eyes of the rest of the world. Without warning, and with every sign of organizing a mass withdrawal, he had actually permitted only a very few to leave the city. A batallion of nearly a thousand men and most of the civilian population had still been in Kunetra when the bomb exploded. Troops of the conquering Western army had entered the city rejoicing, and swiftly passed through to the eastern plain with a numb sickness in their hearts and a haunted look in their eyes. War they were used to, but this was massacre on a brand new scale. Perpetrated in their own names.

After the fighting units had passed, the holding troops moved in behind to tackle one of the most nightmarish and soul-destroying jobs in total warfare—cleaning up after a massacre. The trouble with neutron sterilization is that it does not last unless recontamination by airborne bacteria is prevented. The winds and the rain were not helpful. There was no time to bury all of the dead, nor had anyone thought to provide portable crematoria. The answer was hasty funeral pyres ignited with jet fuel, and a room-to-room search of the entire city to remove the bodies of every man, woman, child, dog, cat or other creature that had been in the city at the time of that fateful blast. Most were found before decomposition had advanced too far, others were not; and the smell of death coupled with that of burning bodies contributed a stench which seemed liable to remain in the fabric of the city's walls for all eternity.

And still Quador's thirst for vengeance was not sated.

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* * *

It was late afternoon before Bowman got the chance to rejoin Early. He picked her up in a half-track he drove himself, and they headed immediately away from the city and up a sloping road to a ledge, from where they had a good view right across the valley. Throughout the entire journey he had been taciturn and withdrawn, and she, recognizing that he was concerned with some inner conflict, carefully restrained her habitual questioning. Then, as the half-track drew to a halt he suddenly became aware of her again. He smiled briefly.

"Sorry, Early. Guess I was lost inside myself. It's this damned place. How much have they told you about Kunetra?"

"Not much. I've read the intelligence reports, but they all seem rather confused. That's part of the reason I came. To try and understand."

"To understand Kunetra you have to live here for a while. Then you only understand what it is, not how it does it."

"So what is Kunetra?"

"It's a pathological killer. That's why I didn't want you wandering around until I'd had the chance to speak to you."

"I don't understand how you can call a city a killer."

He swung his hand to encompass the city beneath their feet. "Kunetra isn't dead. It only looks that way. Quador knew that one day we had to come—that all this was inevitable. He knew there was no way we could afford not to come. And he had years to make his preparations."

Far from the east came the almost continuous rumble of a chain of explosions. Bowman gazed toward them speculatively, almost longingly, as though open warfare were the thing he most desired. Then he looked round at the long hills cradling the valley. Already the disc of the sun was half gone behind the distant ice-clad peaks, and the long shadows were striding across the torn city like a blanket being mercifully drawn to hide the hideous wounds of war. His face remained impassive but the crows-feet in the flesh around his eyes betrayed the tenor of his thoughts.

"Quador was like that, Early. Cast in the mould of Gengis Kahn. An innate tyrant. Terrible in victory, terrifying in defeat. He knew he must lose Kunetra, but he's made sure that for us it's a very painful victory. The only thing to be said in his favor is that he remained with his men. He was still smiling when we put his body on the fire."

He turned back to study the darkening roofs of the city itself. From the high slope on which they were standing they had an almost perfect view of the jumbled streets and houses spreading away from the relative orderliness of the old walled city and the citadel which lay at Kunetra's heart. Over the centuries many other armies had fought for possession of Kunetra, but the previous victors had always taken a living city. The city before him now was very, very dead. Yet not dead . . .

"Quador's left something in the city waiting for us, Early. Something in-

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human yet intelligent. Something electronic yet programed with all of Quador's own malignant spite. He's left us something which waits and watches and selects—then strikes, always in such a way as to cause the greatest distress to the greatest number. Sometimes it strikes massively, when that suits its purpose. More usually it does it with a wry economy. It doesn't need to kill the patient if it can kill the surgeon."

"I still don't understand, Sandy."

"You will. Kunetra has been wired to become the most ingenious death trap in history. Somewhere—and we may never find it—in some radiation-hardened bunker there has to be an advanced computer, programmed to kill. And I doubt if there's a useful room in the whole city that doesn't conceal some potentially lethal device linked to it. The question is, what can we do about it. Because unless we can deactivate it we've no chance whatever of putting a garrison in here."

"Is it really that serious?"

"Worse than serious. It's diabolical. Eighty-three men from the advance cremation party died through drinking poisoned water—water which had previously been tested and certified as fit for use. Some mechanism in the line to that one single tap made an injection of some fungoid toxin at a highly critical time. The men took a week to die, and there was nothing our medics could do for them."

Early shivered suddenly, and it was not only the fault of the evening chill.

"Can't we just abandon Kunetra?"

"No. It's ideally suited for our supply base. And my God, we certainly need those supplies in support of the eastern front offensive. Nor can we just raze it to the ground. Kunetra existed long before the Romans came. They conquered it but they didn't destroy it. They added to it, left something of themselves in it. Christ's own apostles walked some of these same streets you now see before you, possibly even preached from these same heights. Unbeatable in war we may be, but I doubt we're so insensitive to the verdict of history that we'd dare erase Kunetra from the map. After all, it's the quality of the future we're supposed to be fighting for."

Early shivered again, and he put his arms around her shoulders protectively. She delicately but firmly removed herself from the embrace.

"Sorry. I wasn't thinking," he said. "It's becoming colder. I'd better get you back. Before we go, though, I have to talk to you about Maidment."

"Colonel Maidment," she corrected.

"Just so. And Tactical Intelligence. I know Maidment is interested in Kunetra. In fact he's sent five operatives here already. Listen to me, Early. Three of them were dead within twenty-four hours of arrival. All were dead within a week of coming here. Kunetra was waiting for them. So why the hell did Maidment send you yere? To make it an even number?"

"Even if I knew, I couldn't tell you," she said simply. "Sandy, I . . ."

"Forget it," said Bowman wearily. He remembered similar arguments too many times before. He removed his cap and brushed his sparse hair back with

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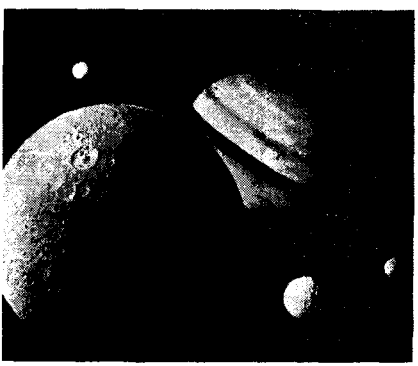

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his hand. "I'll take you back to your caravan."

She looked thoughtfully down at the city, now shrouded by the approaching night. Against the low stone balustrade she turned. "There's still something I don't understand. You mentioned that this something Quador left for us was selective. My impression was that you thought it could respond to particular individuals. Could it do that?"

"It's the only conclusion we can come to. It is selective. I wasn't joking when I said it will kill the surgeon rather than the patient. It actually happens. It kills the surgeon, and both of them die. Two for the price of one. Quador's logic. But I swear it does know one from the other."

"But how could something—a machine—possibly know who was who?"

"You're from WarTech, Early. I was hoping you'd be able to tell me."

She shrugged, buttoned her jacket closely round her shoulders, and climbed into the bucket seat of the half-track. "Don't ask me. I'm only one of the workforce."

Bowman climbed into the vehicle beside her and set it in motion. The surety of their progress down the unlit slopes gave her a hint that this was not the first night Major David Bowman had made the pilgrimage to that particular ledge above the city. She glanced at him, ready to speak, but he seemed to have lapsed back into his previous introspection.

Halfway down the hill, at a point where the roads divided, she saw her opportunity. "What was Quador like,

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Sandy? Did you ever meet him? Before the war, I mean."

"Not I. I saw him only once in passing, many years ago. But if you're interested in Quador, why don't you ask Maidment. By all accounts they were fellow students at Oxford together. Shared the same lodgings. If anybody could understand Quador's twisted logic, then Maidment is that man. Small wonder the bastard won't come to Kunetra himself."

Early was saved from having to reply. The half-track's radio, crackling and occasionally bursting into the spontaneous reception of extraneous half-conversations, suddenly became loud and clear.

"Kunetra Control calling Major Bowman. Emergency."

Bowman reached for the handset without halting the pace of their descent down the slope. "This is Bowman. What's the problem, Control?"

"No details, Major. But the Provost wants you urgently. Map reference twenty-three sixty-eight. Repeat two three six eight."

"Got it," said Bowman. "I'm on my way." He turned to Early. "Sorry about this, but I'll have to go straight there. Come to think of it, it may be useful for you to come along anyway. Get a first-hand experience of what our emergencies are like. There's a map under the dash there somewhere. Can you fish it out and see what's at that reference?"

Using the map light, Early explored the folded pages. "It says the Chapel of St. Simenon."

"Damn! That's the one that's been adopted as the garrison chapel." He glanced at his watch. "And the Padre will be just about halfway through his evening meeting. . . ."

He did not speak anymore, but concentrated on driving. There was no other traffic, but the streets were completely dark and many were hazardous with fallen rubble. They reached the chapel in about twelve minutes and drove to a halt behind half a dozen half-tracks and trucks. Bowman ran up the steps with Early at his heels, took ten paces inside and then said: "Oh, my God!"

The Padre had been pierced very centrally through the chest by a steel barb fully eighteen inches long and an inch in diameter. The device which had fired it had somehow been built into the ancient lectern from which he had been reading. The force with which the barb had been projected had carried the unfortunate man back against a large, vertical wooden pillar and pinned him there, where he hung, head dropped forward, a look of incredulity on his face, as if still amazed by the suddenness of his own transition from life to death. The congregation, fully two dozen servicemen and a couple of civilian technicians, had mainly returned to their pews, to continue their prayers alone.

"The surgeon not the patient," said Bowman quietly. He turned to the Provost. "Get your men here and tear this place apart. See if you can find the camera which set this up. And see if you can trace the circuit from that bloody death trap there."

"Tonight, Major?"

"Tonight." He turned away and

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walked back down the aisle shaking his head sorrowfully. Early followed him.

"What makes you think there is a camera, Sandy?"

"There always is. That's how the thing in the city knows who we are and where we are. That bolt-throwing device could have been placed there years ago, ignoring everything and everyone, until someone it wanted to kill stood just in the right place at just the right time. Eternal patience and a hundred thousand eyes—that's the face of Kunetra the killer."

"Will the camera be difficult to find?"

"Probably. You should see how small they can make them. But it's easier when you know that one is there."

"When you find it, I'd like to have a look at it."

"Surely. But it might take awhile." Bowman scanned the chapel's complexity wryly: a wealth of dark beams and fretted screens, an ornate gallery, religious symbols and carved reliefs and statues of saints, a fusion of Christian and Islamic arts. "It has to be up there somewhere. Regrettably, the only time we know where to start looking is after somebody has died. But even then we still have to find it."

"Surely by then the camera has already served its purpose?"

"Early, would you be willing to stake your life on the chance of there not being a second lethal device concealed here somewhere? Or a third? One possibly already targeted on your heart if you take a single step to right or left? I wouldn't." Wan under the chapel lights, he seemed already to have aged another year. "It's already killed five Tactical Intelligence operatives. If I ever catch up with Maidment I swear I'll kill him myself for sending you out here. Come, I'll take you back to your van."

Early

Bowman dropped her off near the tarmac base on which the WarTech caravans were located. All the vans were in complete darkness except for one in which, presumably, Corporal Hammond was doing his night-long stint. Having said goodbye to her escort, Early stood at the edge of the tarmac and waited until the half-track had rounded the bend in the road. Then she went straight to the caravan from which dim lights showed.

The door was unlocked. Most of the equipment which had been delivered by helicopter had been unpacked, but none of it had been installed. In the center of a mess of packaging, on an improvised couch of polyether foam, Corporal Hammond lay fast asleep. A half-empty bottle of brandy stood close alongside.

Early grinned mischievously as she approached the recumbent form, and prodded him playfully in the ribs with her shoe.

"The last message I had from you said you were spending all night testing and installing the equipment. Did you break a leg or something?"

Corporal Hammond, alias Colonel Maidment of Tactical Intelligence, sat up and grimaced. "Not exactly. But you know perfectly well, Early, that I can't

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tell one end of a soldering iron from the other."

"You would if you'd ever tried picking one up the wrong way," she said severely. "Instant education." She turned her attention to the scattered modules and began rapidly assembling them into the prepared racks around the walls. When the last was in place she turned the master switch and the whole installation came to life.

Maidment blinked at it curiously. "Don't you have to test everything first?"

"No need. The mean-time between failures on this class of equipment stretches out to somewhere around the time the sun goes cold."

He watched her critically as she trimmed the VDUs and began to load the master program into the computer. "You know, Early, I sometimes wonder what I'd ever do without you. How did your *tete-a-tete* with David Bowman go? Did I get away with it?"

"As a character you weren't very convincing, but he certainly doesn't suspect that you are who you are."

"You say that with conviction."

"Poor David is very disturbed that you sent me into such a dangerous situation. He swears he's going to kill you."

Maidment laughed softly. "In which he joins an ever-increasing fraternity of hopefuls. Fortunately I'm not easily killable. But if my disguise convinced him, it's a reasonable sign that it may achieve its intended purpose. After all, I hardly went through all that plastic surgery just to convince Major Bowman. Did you learn anything else?"

"Mainly confirmation of what we already know from the intelligence reports. The thing can recognize individuals, and it appears to have an ordered priority for their despatch. It also has a sense of timing. I'm afraid the Padre met with a summary crucifixion right in the middle of his sermon tonight."

Maidment laughed involuntarily. "I love the phrase 'summary crucifixion,' Early. It has a subtle black humour. I sometimes wonder which of the two of us is becoming the harder."

"It's something to do with the company I keep," said Early darkly. "The point was that it seems able to choose not only the individual but also the occasion. The Padre had read from that same lectern ever since the chapel was adopted. Probably a couple of hundred times. Yet only tonight did it strike him down. Why tonight?"

"Perhaps it was just his turn in the ordered priority."

"Possibly. Personally I doubt it. Apparently tonight the Padre had his largest congregation ever. Not many, but the best he'd had."

"The principle of the greatest distress to the greatest number. That figures."

"It figures even more if you consider what day it is."

Maidment scowled and searched in his pocket for a diary. "My God! Good Friday. Assuming it's not a coincidence, the implications are pretty far reaching."

"The implications, Colonel, are that the men backing Quador technically

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have developed AI—artificial intelligence—to an unparalleled degree. Certainly to the human level, possibly much higher. I think we aren't dealing with simple recognition and response. We're dealing with something which can bide its time, act stealthily, and refuse to show its hand until it considers the time is optimum. As David Bowman puts it: 'it doesn't need to kill the patient if it can kill the surgeon.' I think I would add now that it probably won't kill the surgeon until the patient actually needs surgery."

Maidment was staring at the wall without actually seeing it, his forehead creased with the old familiar lines of concentration that even the extensive plastic surgery had been unable to eradicate. His powerful body looked reposed but was actually taut like a coiled spring.

"I hope you're wrong about AI, Early. It could make things very difficult for us."

"And very dangerous, Colonel. Undoubtedly your face is in its files. You've done too much damage to Quador for them to have left you out. You're probably on a priority hit list. But you've come in disguise. The trouble is you'll never know whether or not it's seen through that disguise until the moment of truth. And for you that could be too late."

"Right little Job's comforter this morning, aren't you. Are you trying to tell me all this plastic surgery was probably for nothing?"

"All I'm saying is that you'll never know whether it was or not until the bolt strikes you or fails to strike as the case may be."

"You're doing nothing to improve my confidence, Child. What's the strength of the opposition?"

"Pretty formidable. Quador's head man on pattern recognition and optical character recognition was Abdul Ferenc. Local born but trained in France and America. Came back to this country to join Quador just before the war. We think he was responsible for the personnel recognition system being used here."

"And on the AI side?"

"Not so clear cut. There were two AI men on our lists, but neither of particularly high caliber. Then there was Ibrahim Shaban, about whom virtually nothing is known in the West except that he developed a computer chess program that could beat a Grand Master . . . anytime."

"That makes him a candidate?"

"Inasmuch as he didn't use any of the standard approaches for a chess program. He used an uncommitted AI approach which effectively produced an intelligent and aware machine. Moreover he managed to give the machine a sense of purpose. It was single-mindedly devoted to winning."

"Then Shaban gets my vote. That sounds like the sort of thing we're up against. Cat and mouse, the long-range strategy. I'm beginning to know how a pawn must feel."

"A pawn, Colonel? From the statistical analyses I've done so far, it's reasonably certain that the Kunetra killer computer has two main priority blocks.

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The first has been prestocked from espionage information. It includes visual recognition patterns for people like yourself and most of the Western high command, senior officers, and the like. A whole group, some of whom might reasonably be expected to come to Kunetra at some time or the other, and whose elimination takes precedence."

"What's the second priority block?"

"The lesser lights. People who happen to have been drafted here just because they were available. Ones who can't be considered to pose any particular threat. Say from Major Bowman down to the latest rookie. They get killed for the sake of causing distress or inconvenience, not because they're particular individuals. I suppose our little underground friend has to make up its own lists for these, based on observation of their roles, and then draw up its own priorities. They're the real pawns in the game."

"Fascinating what you can do with statistics."

"Isn't it. But pay attention to the moral of this tale. You come here with a hopefully unfamiliar face, posing as a corporal. That's your role, and you've probably already been so listed. Providing you continue to act like a corporal you're relatively safe, because you'll stay in the lower priority block. But if you start acting like a colonel, it'll probably take a closer look. It may well promote you to the first block, either by intensive re-examination of its recognition data or simply by deciding to eliminate a potentially dangerous unknown."

"That's why I fetched you along, Early. So I can move around without breaking my cover."

She turned around and concentrated on the screen of a VDU on which was slowly building the trace of a statistical analysis.

"You're a bastard, Colonel Maidment!"

"I know, Early. It's a habit I'm finding difficult to break."

"You knew all that I've just been saying before you ever came here."

"Not in the same words."

"Damn the words! If you've re-written the rules of the game to cast yourself as a pawn, what position have you allocated to me?"

"I rather thought the White Queen," said Maidment softly.

Maidment

Major Bowman looked up in surprise as Corporal Hammond strode into his office almost as soon as the door had been opened. The Corporal had obviously walked all the way down from the Wartech vans; and though it was early the sun was already powerful and the Corporal's jacket was streaked with sweat. Bowman returned a perfunctory salute and settled behind his desk.

"Good morning, Corporal. Manage to finish all your chores last night?"

"I had the whole thing up and finished by five this morning, Major. Lieutenant—ah—Annandale has it running already."

"You can't have had much sleep."

"Not unusual in the Signals, Major." Hammond removed his bifocals and

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polished them carefully. "Lieutenant Annandale presents her compliments and asks you to give to me the complete personnel records for the Kunetra detachment, officers as well as men, past as well as current."

"Like hell I will! I doubt if she's even entitled to read them, let alone take possession of them."

"Only for twenty-four hours, she said."

"Not for twenty-four seconds if I have my way."

"Then she asked me to give you this, Major." Hammond produced from his jacket pocket a sealed envelope which had been untidily folded in thirds. He straightened it and handed it to Bowman, who regarded the sweat marks on the cover with some distaste.

Bowman read the contents, stiffened, and then said: "It would seem the Lieutenant claims some very powerful friends. I'll have to sort this one out with the C.O. Wait here." He went off down a corridor and returned about five minutes later looking chastened. "You win," he said ominously. "But I'll be having a few words with her later about this. Pulling a trick like that on me."

"Sir?" asked Hammond innocently.

"Oh, never mind! How do you intend to transport them?"

"I thought I might be allowed to borrow a half-track."

Bowman shook his head like a man coming out of a daze. "A half-track and all the personnel records gone, and it isn't even eight o'clock yet. This is going to be one of those bloody days, I know it. I'll find somebody to help you load up. All the officers' records will be in a locked cabinet. Only Lieutenant Annandale is to have possession of the key. Is that understood?"

"Perfectly, Sir."

"Are you staying on in Kunetra?"

"I'm not sure. Depends if the Lieutenant wants me."

"Then speaking of personnel records, I wouldn't mind seeing yours, Corporal. Or hers, come to think of it. After all, you are on detachment here."

"Perhaps the records were delayed in the post, Sir."

"We don't have post in Kunetra. All records and correspondence are handled by facsimile transmission. Bit difficult for that to get delayed."

"I'll mention it to the Lieutenant, Sir. Perhaps she knows."

"Do that." Bowman returned the salute with a gesture which was also a wave of dismissal, and tiredly returned to the job of tidying his desk.

Corporal Hammond collected his laden half-track, briefly considered his route, and decided to make a detour. Thus far he had seen virtually nothing of the city of Kunetra, and accordingly he felt it was in keeping with his assumed character to make a brief if unauthorized exploration. He turned the half-track into the city instead of keeping on the perimeter road, and within minutes was engulfed in the maze of empty houses, shops and covered native *souks* or markets which were so characteristic of the area. The older buildings appeared to be made of a mixture of mud and straw, with a surface skim of something harder, now mainly cracked away. The newer

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buildings were of reinforced concrete posts infilled with building blocks. They were just as ugly as the old ones, with steel reinforcement rods rising forlornly from their flat roofs on the off chance that somebody might one day want to build above. The whole suburbs had about them the air of a city started but never finished. He wondered vaguely if it ever would be finished now.

The old town proved something of a contrast. Here the houses were taller and the roads even narrower, and he had difficulty in taking the half-track through. Typically, on crazy projections of gnarled and twisted wooden beams, the upper stories overhung the frontages to such an extent that the buildings nearly met overhead in the center of the street. Samuel Pepys might have recognized a similarity between this and the streets of ancient London in the days before the great fire.

Then suddenly the half-track broke out onto a broader, modern avenue, skirted an ornate mosque, and slowed suddenly to a halt as it turned a corner and fetched up short before a gang of sweating sappers engaged in digging a deep channel diagonally across the road.

A provost sergeant waved him back a little. "Sorry about this, Corp. You can either go back the way you came or wait about twenty minutes till they fill the end of the ditch."

"What's going on then?" asked Hammond.

"We're trying to trace the circuit of the device which killed the Padre. They've followed it out to the street. Now they're trying to find where it goes from there."

"Looks a tough job."

"Tough? It's bloody impossible. Look at this."

He handed Hammond a length of black plastic, scarcely a thirty-second of an inch in diameter.

"What is it?" asked Hammond. "Doesn't look like wire."

"It isn't. It's an optical fiber cable. Most of the devices we find are powered by long-life batteries, often topped up by concealed solar cells. But the instructions come in through optical fibers like this. Even the cameras communicate back in the same way, using digitized video signals. The damn problem is trying to trace where the cables are coming from or going to. They've already broken this cable about sixty times just following it down the road. And we know before we start that the attempt is useless."

"Why's that?"

"Because every so often they've run it through a block of concrete. You know where it goes into the concrete, but you don't know where it comes out. And if you smash the concrete, you destroy the cable. There's no bloody way you can follow it. Are you going to turn?"

"No, I'll wait. It's the first time I've seen anything like this."

"You're welcome. I've seen enough to last me a lifetime."

There was some sudden activity at the far end of the trench, now perhaps some forty feet away, and an officer was directing his fatigued and sweating squad

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to act with caution. Apparently the customary concrete baulking block had been reached, and the theory was that if they could strip the road surface from it carefully enough they might—just might—find the continuation of the cable. None of the men with the pick-axes seemed at all enthusiastic about the idea. Finding a needle in a haystack while wearing boxing gloves seemed a far better bet than locating a fragile black thread in a bed of compacted and tarmac-coated hard-core. Nonetheless the operation was attempted.

Hammond-Maidment's recollection of the next sequence of events was rather hazy. He dimly remembered the concrete block and the roadway opening up, and bodies being hurled into the air. Then he had been smitten by something he could only imagine as an iron bar traveling at a thousand miles per hour, and had reawoken some unspecified time later to find himself dazed, bruised, and bleeding in the roadway with the half-track toppled over against him. Miraculously it had missed crushing his legs by a mere inch, and its bulk had taken the brunt of the blast and the flying debris. The sound of the sirens of approaching emergency vehicles reflected from the buildings around him so many times that he had no idea from which direction they would arrive. The predominant sound was somebody close by screaming. Those who had been at the far end of the trench would be beyond the need to scream.

He struggled to his feet and made his was unsteadily around the front of the toppled vehicle, and stopped, appalled. The scene before him was barely recognizable as the street he had been watching a few minutes earlier. In the center of the road was a vast crater, and the shops on one side and the chapel on the other had been damaged so extensively that the roofs and frontages were gone entirely. Only the provost sergeant, and the two sappers who had been coming back to start in-filling the near end of the trench, were still alive, and all were injured. Of the officer and the dozen men who had started to clear the road surface from the baulking block there was very little to be seen at all. Just occasional blood-soaked fragments. Pent up in its thick concrete shell, the waiting mine had exploded very violently indeed, and Hammond-Maidment knew he was incredibly lucky still to be alive.

The emergency vehicles were quick to arrive—an ambulance, a fire engine and two half-tracks. Bowman himself was in the leading vehicle, and dropped off by Hammond's toppled half-track.

"You all right, Corporal?"

"Shaken. But I'm no emergency."

Bowman pressed on, turning his attention to getting the ambulance closer to the injured men. Then while the stretcher party moved into action he walked to the edge of the crater and came back to Hammond shaking his head.

"It's a filthy business. Any idea how many were there when she blew?"

"About twelve, I think. Any hope?"

"Not for them. Just bits and pieces. They must have been standing right over the bloody thing."

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"They were trying to strip the road surface from over a concrete block."

"And something decided to teach them not to be so damned inquisitive. It's done it before. But tracing the cables is the only chance we've got of finding this thing and stopping it." Bowman looked at the the toppled half-track, and his own personnel records scattered across the road, as if he had only just seen them. He turned back to Hammond, and there was a questioning speculation in his eyes. "A bit off your route here, aren't you Corporal?"

"Thought I'd have a quick look around while I had the transport. First opportunity I've had."

"That first opportunity was nearly your last. Another twenty yards and you'd have been in the center of that lot." Bowman nodded toward the crater. "Take it from me, Kunetra's no place for sightseeing." He was peering at Hammond's face as though there was something he felt he ought to remember about it. "That's a very nasty cut above your eye. You'd better come back to camp and let the Medical Officer do something for it. No sense in taking chances."

Bowman was suddenly hurried away to take a call which had come over the radio in the fire engine. Another half-track with chains righted Hammond's fallen vehicle, and Hammond recaptured most of the personnel documents. In the meantime the ambulance had left with a blare of sirens to take the wounded back to the camp infirmary. All that remained to be done was for somebody to collect what was left of the men who had been close to the bomb when it exploded. Then Major Bowman came back, and the expression on his face was that of a man who had just seen his own ghost.

"Forget about that trip to the M.O. He's dead. Something just shot him through the bleeding heart."

"Q.E.D." said Early. "We are up against AI." She was treating Maidment's cuts and wounds with expert hands. "I wish you executive types wouldn't bleed so much."

"If you must insist on opening up the wounds and rubbing salt in, of course I bleed."

"It isn't salt. And you are going to have an anti-tetanus injection, even if I have to knock you out to give it to you."

"I told you. I'll be all right."

"Yes, you will. You're getting treatment in time. It's those poor devils who were injured who are at risk. With the M.O. gone."

"Isn't there anyone else medically qualified?"

"Not since the last blowup. Skilled medics have a high mortality rate in Kunetra. Why don't I go down there and fix the men up—at least until they can be flown out?"

"I considered that, and decided against it. It'd be too damn risky."

"Too risky for the White Queen?"

"Especially risky for the White Queen with Tactical Intelligence flashes on her shoulders and a knowledge of medicine among other things. I'm reasonably sure it wouldn't hesitate to strike you down

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immediately. I can't afford to lose you, Early. Blast!'' The exclamation was caused by Early's inserting into his arm the needle of a hypodermic syringe she had prepared behind his back. ''Besides, you've got work to do here.''

''More important than trying to save the lives of three men?''

''Yes. Like trying to save the lives of the next three thousand. GenStaff is determined to use Kunetra as a supply base irrespective of the cost. We can't locate and destroy every damn device that's been hidden in the city, so we have to go for the thing that controls them.'' He nodded to the boxes of personnel records. ''Let's get those tabulated and into the computer.''

''What are we looking for?''

''Heaven alone knows. Everything or nothing. A pattern, perhaps. Somebody who has survived Kunetra too long. Or somebody who didn't survive it long enough. A window onto the thought processes of our enemy. Its strengths and weaknesses. Perhaps even its face.''

''I know what its face looks like. David Bowman told me. 'Eternal patience and a hundred thousand eyes—that's the face of Kunetra the killer.' ''

''Poetic. But I wonder if it's true.'' Maidment was examining the hypodermic puncture on his arm. ''And if it is, what happens if we make it lose its patience?'' He looked up, and the familiar lines of his formidable powers of concentration creased his unfamiliar forehead. ''Exactly what does it take, Early, to drive an artificial intelligence insane?''

The next few hours were spent in pure routine. Maidment accepted the task of transferring to punched cards all the relevant information from the garrison records. Early set up her computers, calling from sub-routines the various statistical analysis routines she wished to have performed, and tailoring these for various methods of display. Finally, while the cards were running through the optical reader, and the computer had begun its task of assimilation and analysis, she turned back to Maidment.

''What was Quador like—as a man I mean?''

''I wouldn't know.''

''But you knew him didn't you? At Oxford?''

He grinned like a schoolboy caught in the midst of a prank. ''You're not supposed to know about that.''

''There's quite a lot of things I know about Colonel Maidment I'm not supposed to know.''

''Then I'll tell you. Whole reams have been written about Quador, and all of them are utter rubbish. I knew the man in his formative years and the truth is very different. In all his life the only thing he wanted was peace. In fact he was so passionately devoted to the pursuit of peace that he was prepared to tear the world apart in order to achieve it.''

''He certainly did that—tear the world apart, I mean.''

''That's the paradox. Quador's logic. Fight to achieve the peace which is the thing you most desire. Was he wrong, Early? If you don't fight for peace, how the hell are you ever going to find it?''

''And how the hell are you ever going

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to find it if you continue fighting? Annandale's logic," she said critically.

Maidment was looking at her quizzically. "Exactly what made you ask that question about Quador, Early?"

"They say he was smiling when they put him on the funeral pyre. I suppose at least he'd achieved a sort of personal peace."

"What are you driving at?"

"We seem to be looking at an artificial intelligence probably structured on the lines of Ibrahim Shaban's unbeatable chess program. A machine imbued with a sense of purpose. Our job could be a whole lot easier if we could gain some idea of what that purpose was."

"And you're suggesting it might be modeled on Quador's own thought habits?"

"I don't know. Just an idea that occurred to me." She was watching a green trace which was building a graph across the VDU screen. "This first set is from my original figures established back at base labs. The plot is of differences in length of time in Kunetra before being killed. Two very distinct classes. On the left is the first priority block, whose tenure was short, sharp and brutish. On the right is the second priority block—the pawns—whose demise time follows a roughly normal distribution curve."

"No surprises there. Let's have a look at this latest batch of stuff plotted in the same way."

Early tapped a few keys on the keyboard, and a second, red graph line crawled slightly above the first. The two shapes were nearly but not quite identical.

"Nothing," said Maidment, shaking his head.

"Nothing in the similarity, but it would be interesting to know what is causing the mismatch." She bent to the terminal, and for half a minute columns of figures flowed across the screen directed by her expert fingers. Finally a printer chattered and gave her a small set of cards. She read them thoughtfully, then on impulse dropped them into her tunic pocket.

"Learn anything?" asked Maidment.

"Not about the Kunetra killer, but I think about another one. Do you know what caused that mismatch, Colonel?"

"I pay you to tell me things like that."

"So I'll tell you. The mismatch was caused by the deaths of the five Tactical Intelligence operatives who came here before us."

"So the Kunetra killer doesn't like Tactical Intelligence. That's hardly a surprise."

"Think about it, Colonel. They were all non-specialists and were drawn from remote parts of the war theater. Nobody could ever have anticipated the possibility of their being sent to Kunetra, therefore their recognition patterns wouldn't have been inserted in the first priority memory banks. They were plainly second group candidates who should have been locally evaluated according to their roles. Any idea what those roles were, Colonel?"

"They're on the cards in your pocket,"

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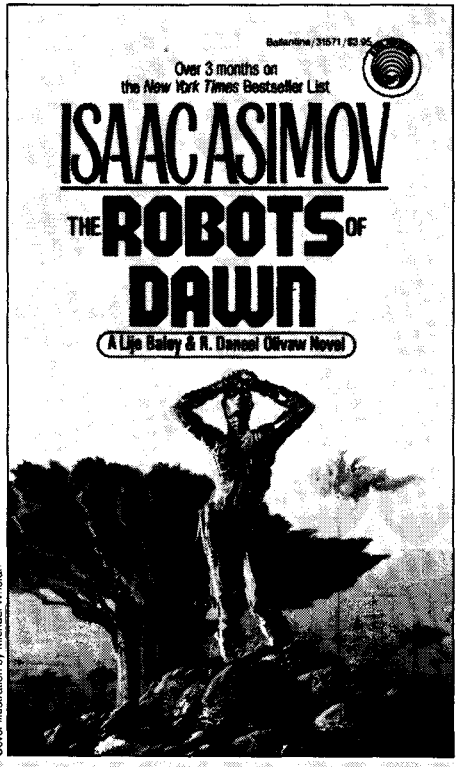
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said Maidment, looking nowhere in particular.

"So they are. Two sappers, one driver, one cook, and one medical orderly. Nonentities. Yet three were dead within twenty-four hours of arrival, and the other two lasted five and seven days respectively. That's statistically untenable. Either they didn't maintain their roles and were detected. Or else . . ."

"Or else what, Early?

"Or else they were betrayed."

Maidment bit his lip. "A rather unlikely proposition. Exactly how would you go about betraying someone to the killer of Kunetra? Go to the door and shout his name? Don't forget that nobody who knew those men had any access to Kunetra, and nobody in Kunetra knew who these men were. Not even Bowman—at least until after the men were killed. There has to be some other answer."

"I think there is," said Early. "In fact, I'm certain of it. I've worked with you too long to have any faith in coincidences, Colonel."

"What are you saying, Early?"

"I'm saying that you deliberately set them up for it. I don't know how or why. But I can detect your filthy hand in this somewhere."

"Child, your lack of faith destroys . . ."

"Five lives, Colonel. Your own men. Can you really justify that?"

"Of course I can. You know damned well I always think the excuses out first."

"Then if I'm to continue working with you, I'd appreciate an explanation."

Maidment sighed wearily. "Shortly after the Kunetra breakthrough, one of our advance mobile units captured a small radio station about three hundred kilometers east. Initially we didn't understand its significance. There had once been a substantial encription facility there, but this had been destroyed in the fighting, and all the staff had either fled or been killed. However, from the orientation of the fixed dish aerials we finally became convinced we had come across the station by which Quador's technicians gave extra instructions to the Kunetra killer complex. We knew by then that it was going to be difficult to find the killer complex physically, but the chance to confuse or nullify it by feeding it false information couldn't be ignored."

Early was staring at the VDU screen as though it was about to give birth to a venomous snake. "Go on, Colonel."

"Our problem was how to use the station effectively. We knew nothing at all about the encription codes or the access protocol for instructing the Kunetra killer, and we could transmit to Kunetra, but we couldn't receive a response. Thus we had no way of gauging whether our messages were being received or understood. Therefore we had to resort to a trick."

"A trick, Colonel? We're talking about five human lives."

"If it eases your conscience, they weren't Tactical Intelligence men at all. Rather they were known Quador sympathizers we'd detected in our own

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forces. We hadn't a hope of re-creating the recognition patterns of the type Quador's men had been using, so we tried a long shot. We took one of our suspect group, transmitted from the station in plain language only his name, rank and number plus the false information that he was attached to tactical Intelligence. Then we drafted him into Kunetra, Seven days later he was killed."

"Statistically probable even for a second-group candidate," said Early archly, glancing at her figures. "What the hell else did you expect?"

"Don't anticipate me, Early," said Maidment sternly. "If you have another look at your figures you'll find it's also within the probability span for a first-group candidate. On that slender evidence we repeated the operation for a second man. He was killed in four days."

"Oh my God!"

"So you see where I'm leading. On the last three men we achieved a hundred percent correlation. All of them dead within twenty-four hours of arrival. We had established our link to the Kunetra killer."

"But it's impossible!" said Early. "How can the killer complex identify a man simply by receiving his number, rank and name?"

"That's what we asked ourselves. The answer was shockingly simple. The records of all personnel and personnel movements to Kunetra go via the facsimile transmission. All the evidence suggests that the killer complex can receive and read that too. Seemingly it puts the two pieces of information together and identifies the man virtually from the moment he steps off the helicopter. Then it makes up its own recognition pattern and simply waits for an opportune time to kill."

"Why should it have been slower to kill the first ones than the later ones?"

"We think it's a question of confidence levels. Once we'd struck on the idea it could read our facsimilies we took to transmitting to Bowman after each death that the individual concerned had indeed been an undercover Tactical Intelligence agent. As you can see, the hit-rate improved remarkably. Confidence established. The Kunetra killer complex now believes everything I tell it."

"Christ! I never thought I should feel sorry for a machine. Now I nearly do. Statistically you had the information you needed after the second death. You used the remaining three just to harden the decimal place. Suspects or not, that was still deliberate murder. I've said it before, but it bears repeating—you're an unprincipled bastard, Colonel Maidment."

"Ah, yes, but a clever one," said Maidment blandly, folding his hands together.

"And this . . ." She waved her hands around the WarTech van and its clutter of computers and instruments. Her voice was rising high. "If you already know so bloody much, what's the point of fetching me out here?"

She looked about wildly, realizing she was near to the point of breaking into tears, then fled abruptly to the toilet cubicle.

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Maidment scrutinized his immaculately manicured nails for a long second, his face a mask of something unnamable and lionlike. Then he picked up a Chinagraph pencil from the tray and went over to the graph traces which still occupied the VDU. There, at the very summit of the peak representing the high-priority death statistics he drew a symbol representing a white queen, and tapped the screen thoughtfully with his pencil.

"My dear Early," he said softly to his absent companion, "you still don't seem to realize what a key piece in the game you are."

Early's crisis of conscience lasted all of five minutes. The sound of a half-track drawing up outside heralded the arrival of David Bowman bearing a small cardboard box. Early emerged dry-eyed from the toilet and took the offering gratefully.

"What is it?" asked Maidment, looking at the slim glass pencil she was still holding after the major had departed.

"One of the cameras which Quador's people installed by the thousand in Kunetra. David managed to get one out intact. Usually they've been cemented in, and the sappers break them instead of trying to preserve them. This one is complete, and ought still to be working."

Maidment examined the prize carefully, then handed it back to her.

"Can you get it running. Hook it up to one of your TV things? I'd rather like to know just how much the Kunetra killer can and can't see—from the inside, so to speak."

"That's what the electronics van was equipped for, but it'll take a while to sort out the digital-to-analogue conversion." She began hunting through a filing cabinet, seeking a particular report. "Actually base labs have already done a lot of work on some of the earlier cameras recovered." She found the sheets and opened them on the table. "Charge-coupled solid state matrix devices. Fixed lens, monochrome, limited resolution. Visual response peaks toward the blue end of the spectrum. Relatively insensitive to reds, completely *insensitive in the infra-red region*. Minimum utilizable light levels . . ."

"Just a summary will do," said Maidment. "What does all that imply?"

"It means, Colonel, that it can't see all that well in daylight, and at night it's completely blind."

"That's just the sort of news I was hoping for, Early. How soon can you get it operating?"

"You need it urgently?"

"Very urgently. Like yesterday was already too late."

She scowled down at some circuit diagrams. "None of this system is standard, and I'm going to have to half-rebuild a monitor to get it to accept the signal. If I work all night, I should have something running about first light."

"That will have to do then. If I'm not already with you by the time you get it going, come and wake me." He reached for the corporal's jacket in which he posed as Hammond, and took up an instant-picture camera and the Kunetra

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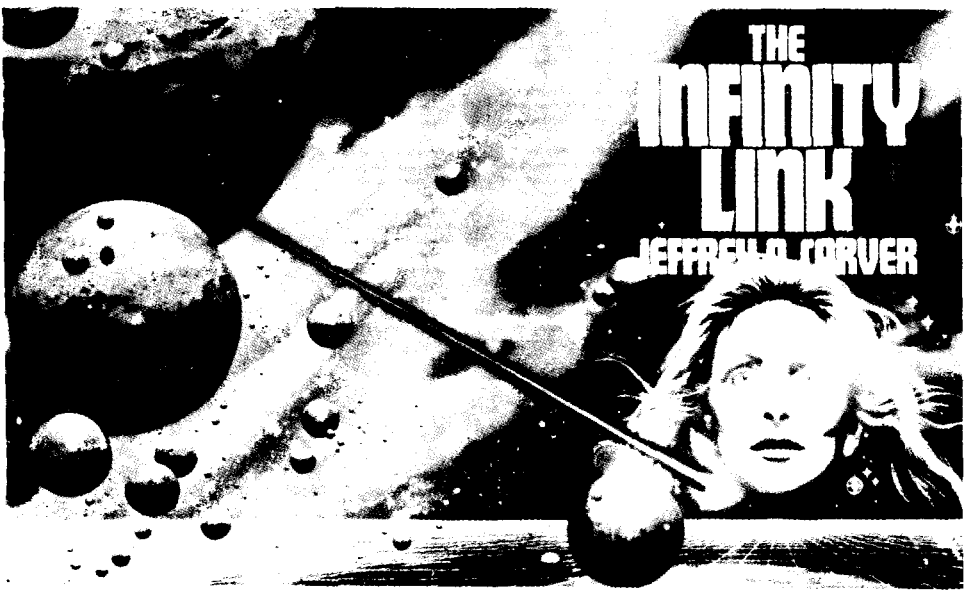

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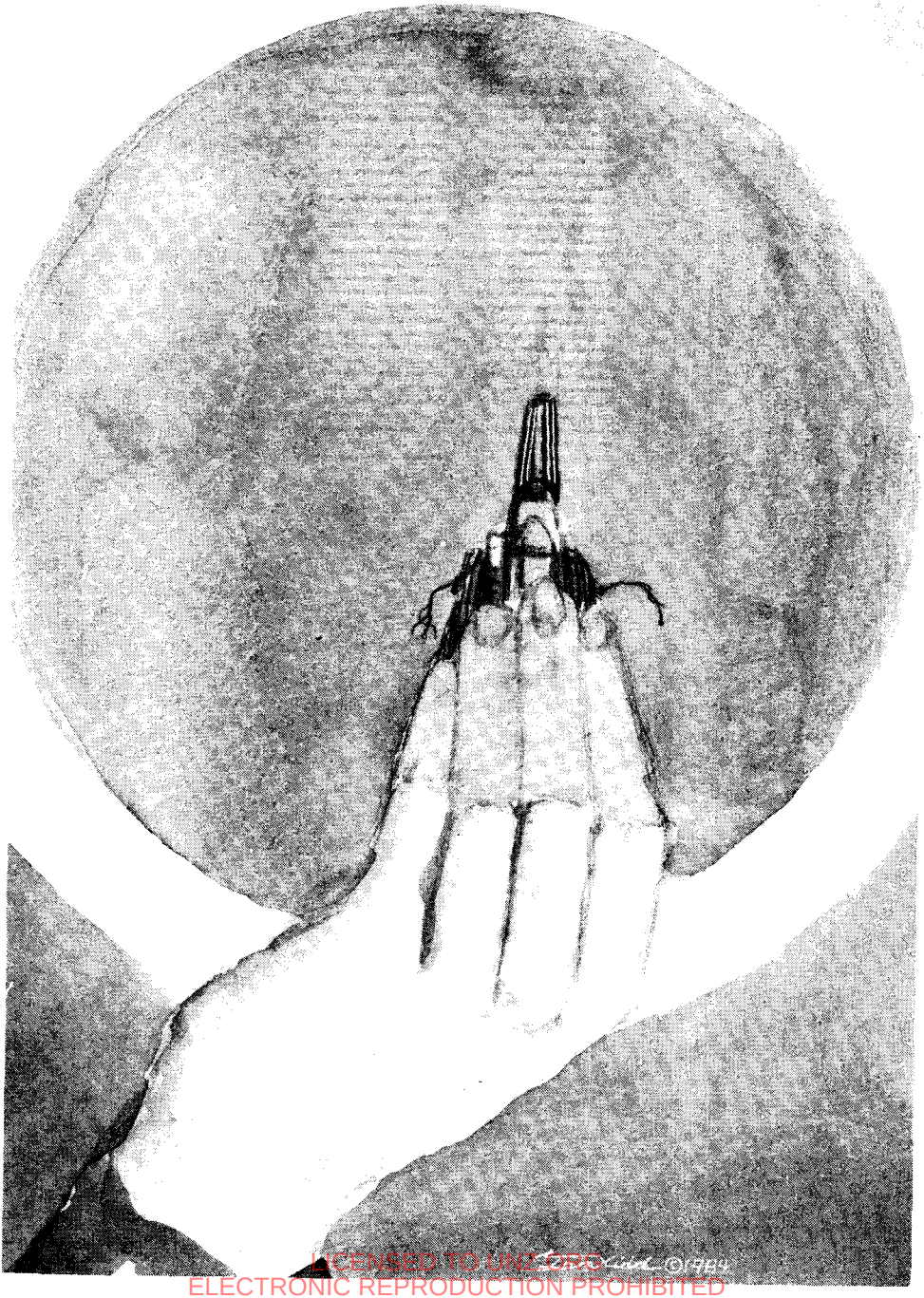

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street map. "I'm away down into the city to get some information we're going to need. Better keep your fingers crossed that the killer complex still has me classified as an innocent pawn. God, I hope those plastic surgeons knew what they were doing!"

"And if they didn't?" asked Early, without any particular emotion.

"Then you're going to have to get yourself a new boss and start all over again."

Taking the half-track, Maidment followed a pre-determined route which took him about halfway toward the old city and into a broad triangle which had once been hedged by an open food market. Here he left the vehicle after a brief glance at his map, and began to walk. The fruits and wares on the stalls had long since been consumed by insects and decay, yet the tattered awnings which had given the former merchants some protection from the sun still maintained the character of the scene. Now it was a place of ghosts, and had he been fanciful it would have been easy to imagine the *muezzin* call to prayer ringing above the rooftops, or to expect, if he turned into one of the small shops, the propietor to emerge from some dim recess to begin his bargaining.

Hoisting his camera for an occasional snapshot, Maidment did his best to maintain the pose of a corporal who had snatched a few hours off from his duties and was out to capture some of the local atmosphere. This was not unusual. Off-duty troops frequently ventured into parts of the city, and had seldom come to grief. It seemed that the killer of Kunetra was not much concerned with isolated individuals whose perambulations appeared to offer no sort of threat to its installations.

Maidment was acutely conscious that the killer had his own recognition patterns already in the high priority file. If it penetrated his disguise or was not convinced by the fidelity of his pose, then it required but the diversion of a few electrons through an electronic switch to trigger the sequence which would deprive him of his life. He could not see any of the cameras which were watching him, but he was certain that he was under surveillance, and that knowledge begat a curious crawling feeling in his spine. As Early had said, he would never know whether his disguise was adequate until the bolt struck or failed to strike. As usual, she was right.

He had a rough idea of the type of place for which he was looking, and his map was ringed with potential sites, the locations of which had been taken from an old directory. None of his information, however, gave him any guidance as to whether or not the marked places were suitable for the purpose he had in mind. Picking the nearest one, he deliberately chose a circuitous route to disguise the pattern of his interests, and wandered off the highway through a minor *souk*. Here rain from a leaking roof had completely spoilt much of the fine cloth which had been on display, and more of the cloth had been soiled by bird-droppings from a noisy colony which nested under the dark eaves. Then

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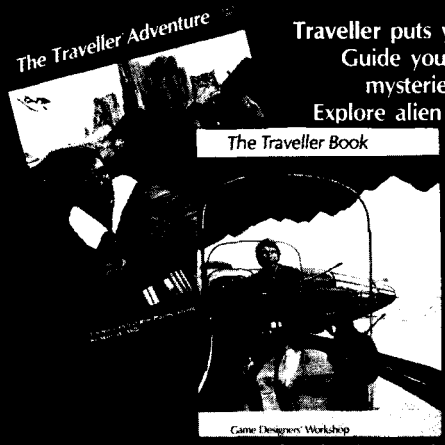

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he was out on to another highway, contriving not to look too closely at the true focus of his attention. A few snapshots from casual angles, and he came to the conclusion that this was not the site he needed.

The amount of his exposure to the attentions of the Kunetra killer increased with time, and it was obvious to him that the longer he devoted to the project the greater were his chances of being detected and killed. Nonetheless he persisted, camera in hand, gradually making a tour of all the places he had noted on his map. None was perfect, but he came to the conclusion that the last site he visited was probably the best. By this time, however, he was acutely conscious of a sense of growing danger, which was a sixth sense he did not dare ignore.

Thankful to have made some kind of a choice, he turned from his path and trailed rapidly back through the incredibly narrow streets of a sector of the old city once famous for its hand-crafted furniture, and soon regained the half-track. Only when he was well clear of the city limits, on the perimeter road where no mines or traps were thought still to be located, did he dare relax again. He brought the vehicle to a halt and in the last rays of the setting sun he had a good look at the final snapshots he had taken. What they told him was satisfactory, so he marked the position heavily on his map and then drove the rest of the way back to see how Early was progressing.

She came and woke him at two o'clock in the morning, visibly tired but pleased with the results of her efforts. The camera which David Bowman had obtained was clamped to a retort stand on a bench at one end of the van, and an assortment of cables showed the degree of patching she had had to do in order to use the potential of various pieces of equipment. The monitor had been stripped out of its cabinet, but the screen was live with a view looking down the interior of the van. The display was a trifle jittery, and was streaked with two bright fly-back lines, but nonetheless the image had reasonable clarity and definition.

"For God's sake don't touch anything," warned Early. "I only had time to get it running, not to get it running safely."

She killed the interior lights in the van, and Maidment advanced toward the camera while watching his own image on the monitor.

"Good work, Early! Have you got a chair? A lab stool would do."

She produced one, and he placed it precisely in the center of the floor.

"Sit on it please, Child. I want to see what you look like to the Kunetra killer."

She sat and watched anxiously as he went to the camera and made some careful adjustments to its angle. Then he turned back and played with the contrast control on the monitor.

"That's about it, I think. A killer's-eye view of Early Annandale. Eerie thought. Forget any ideas you might have had about getting to bed tonight. We've got a lot of work ahead of us."

* * *

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Something

He was *something* in Kunetra, a guardian, perhaps. In a sense he *was* Kunetra. And all he wanted was peace.

His gaze wandered around the city, a floating consciousness that could transfer its vision at will from one eye to the next. Metaphorically he took a stroll around his favorite places, the view from one camera supplanting the next in ordered sequence, almost as though he were actually out there walking or flying through the streets. Under the iron canopy of the *souk* called the Street of the Long Mile the birds had returned to take possession of the rooftop crannies. He did not mind the birds; birds were peaceful. It was people who destroyed his peace.

He wove his way down the length of the *souk* to where the canopy ended and the way again became open above. The bright sunshine forced him to skip the view from a camera which was blinded by direct exposure to the sun. Then he was caught with the view of a different century as he leaped between rows of great stone columns placed there by the hands of the Romans themselves. Finally he reached the place to which he had been heading—the Great Mosque of Kunetra. An exquisite example of Islamic art and architecture, the mosque had about it an eternal quality, a place in touch and in tune both with the past and with infinity. The very care which had been taken by its builders in preparing the carvings and mosaics, and the overall conception of its form, were proof to him that they too shared this feeling. He knew nothing about the builders. They had all died on the day he first became conscious.

He stopped with his gaze directed across the great open courtyard, with the towers and minarets in clear relief against the sky, and wondered exactly why he had brought his attention to this place. Then he realized the answer was his own disquiet. All he wanted was peace, but people tended to deny him this; and for that reason he had been provided with arms. He knew who his main enemies were, and these he could destroy fairly quickly. Then there were others, not dedicated enemies, but soldiers who tramped all over his favorite places and sometimes tried half-heartedly to find him. They were a nuisance, but he could control them. Occasionally he culled some to keep their numbers down, and occasionally he taught them an object lesson to stifle their arrogance and spoil their morale. But he did these things only rarely because his stock of arms was finite and could never be replaced. But now he was facing a menace of quite a different order—Early. Why, oh why, had they had to bring Early to Kunetra?

For about the millionth time he turned his attention to the files in which details of her identity were lodged. The earliest had been filed in the stilted Arabic format of Quador's espionage agency, but he knew the details so well that he used his own paraphrase: 'Lieutenant Early Annandale, Department of War Technology, seconded to Western Tactical Intelligence as Personal Assistant to the departmental head, Colonel Maidment. Outstanding electronics technician with

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a medical background. The Early-Maidment combination believed to have been responsible for a great deal of damaging espionage and counter-espionage against units of Quador's forces. Recommendation: destroy at the earliest opportunity.' He had also received a very full set of her identification patterns.

He moved his attention out of the courtyard then, switching to the cameras in the mosque itself. The site had been a place of religious worship for over three thousand years. The first known was an Aramean temple built to Hadad, god of storm, rain and fertility. Later, the pagan Zeus had been accorded a temple there, then early Christianity had flourished, finally to be supplanted by Islam. And each faith had left a little of itself, either in the fabric, the relics, or in the atmosphere. Now the decor and form was dominated by Islamic art, from the marble mosaics of the floor and lower walls, to the gilded designs and frets which continued to the ceiling. Even the arches of the porticoes and colonades were inlaid with mosaics. A monument of dedication. A monument of peace.

And now they had sent Early to Kunetra to threaten that peace. Why was Early so special?

The second record gave him more of the answer. It had been originated in plain language by somebody called Hammond, and gave exhaustive details of Early's training and capabilities. Somewhere near the end it read: "Early is believed to be a world authority on the uses of Artificial Intelligence in warfare. Her multi-disciplinary training and her ties with Western Tactical Intelligence put her in a unique position for countering AI orientated devices in the field, at which she has achieved a hundred percent success rate."

He could find no information on Hammond himself, but the file entry had come in via the radio link through which he still received updates from the East. The file access codes on the report had been corrupted or were missing, but there was no doubting the validity of the data. Hammond had sent similar entries in the past, and five Tactical Intelligence operatives had been detected and eliminated. He had himself been able to verify that the men destroyed had actually been working for Tactical Intelligence. Ergo, what Hammond reported was obviously to be taken as fact.

And Hammond, too, regarded Early as dangerous.

Suddenly the quietude was not enough. He tried the sensation of motion, swinging his vision suddenly from camera to camera away from the mosque in a simulation of traveling at speed, as he began to consider the facts. In the heart of the Kunetra Citadel was a Roman amphitheater, almost complete in its state of preservation, and with the sixteen cameras available to him there he took to swinging his field of view round the great open stone galleries like a bird in flight. With part of his mind thus dissociated he felt he could concentrate more readily on his problem. Whichever way he considered it, Early was dangerous to him. She was probably the most dangerous person who could possibly have come to Kunetra.

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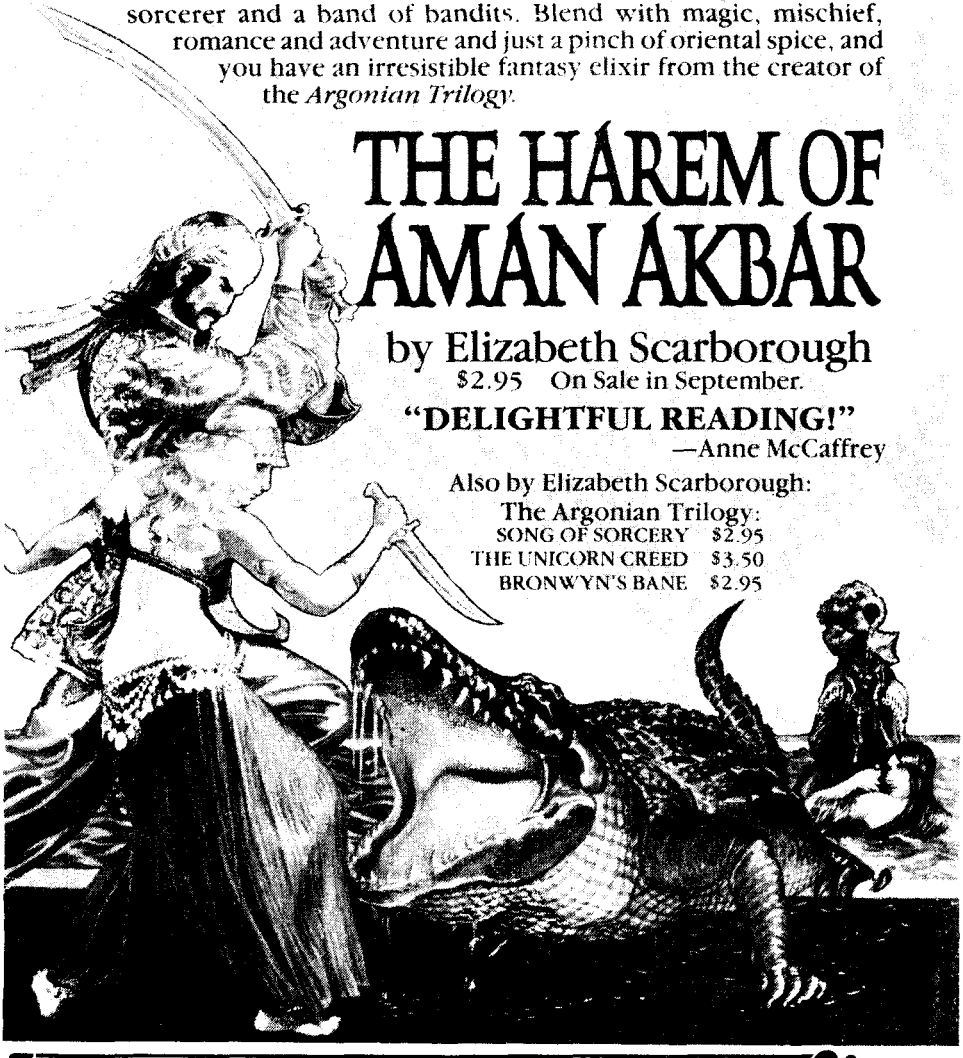

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Facts. Firstly the WarTech caravans had been flown in and set down on the side of a hill where the ground had been so worked by heavy vehicles that none of his own arms there had survived. Then Early had arrived, unannounced by the facsimile transmissions, and brought with her a great deal of electronic equipment. Her companion, similarly unannounced, had all the trim of a fighting man, yet appeared to treat her with deference. Major Bowman had made a particular point of meeting Early off the helicopter, had placed her in a safe situation all afternoon, and had later taken her out to an even safer position where, presumably, she had discussed her plans.

The situation began to look critical. As an element of psychological warfare the elimination of the soldier-priest had seemed ideal, and the timing opposite. The sting lay in the retrospective analysis: Bowman and Early had actually been on their way to the chapel *before* the soldier-priest had been killed. Coincidence possibly? Or not coincidence? Could she possibly have known of his plans to destroy the soldier-priest? If Early was all his records told him, the possibility could not be ruled out. How clever could she be? Take the following day. Her companion similarly had arrived at the scene at which the mine had been exploded *before* the decision had been taken to detonate it. Precognition or analytical genius?

With a flurry which was the nearest an artificial intelligence could come to panic he suddenly terminated his flight of fancy and instantly concentrated his attention on those visual sensors nearest the WarTech vans on the hill slopes, switching his vision there directly instead of taking a sequential route. Currently nothing much was happening. There was no sign of Early herself, although her companion occasionally emerged and went to one or another of the vans, carrying pieces of equipment. He had wondered before about Early's companion, but had been unable to find a valid identity match. He could have killed the corporal half a hundred times as he had wandered round the city, but judged now that he was right not to waste the arms. Early herself was the real danger.

For two hours he concentrated on the scene around the vans, looking for any signs that might give him a clue as to Early's intentions. Then, as dusk was falling, three half-tracks came up from the camp bearing fully a dozen soldiers, with Bowman at their head. They stopped before one of the vans and started to load pieces of equipment into the vehicles. This done, they all sat down and started leisurely to brew a hot drink on a portable stove, glancing occasionally at the disappearing disc of the sun. Suddenly the cleverness of Early's plan became shockingly apparent. She was planning to attack him at night—and after dark he was blind!

There was nothing he could do, no defenses he could call on while the group stayed by the vans. Later, as they drove into the city, as he had no doubt they would, he would be able to pinpoint them by the vehicles' lights, and he swiftly reviewed the web of mines

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and traps available to him on any of the routes accessible from the WarTech vans. He had more than sufficient arms to eliminate her task force several times over, and the satisfactory foreknowledge that in total darkness they were just as blind as he. Perhaps he was worrying unnecessarily about Early.

Then Early herself came out of a caravan and sat among the soldiers, drinking from a large cup and laughing. He captured a set of images of her, deblurred them by fast-Fourier transform processing, and studied the enhancement. Compared with the company she was keeping, nothing about her suggested any kind of menace. True she wore a uniform, but she appeared a perfectly normal young woman, even pretty by the standards he had to judge against, and her reactions with the men were light and normal. Some tension inside him ebbed away. He had taken her threat too seriously. Then suddenly he was again unsure, for she had taken up some apparatus and was looking through it at the sky. She was measuring the level of illumination which would be provided by the slim crescent of a very young new moon. . . .

The sun dropped behind the hills and the afterglow began to fade. He watched with a kind of fatalistic calm as she called the men to their feet and directed them to their half-tracks, apparently explaining something important as she did so. In the last moments of available useful light he saw her again raise her measuring instrument to the sky, then sweep it around the shades of the slumbering terrain. He managed to capture that image too, and deblurred it. Even the enhancement was poor, but it was perfectly easy to see that Early was no longer smiling.

He was not sure whether he actually saw them start, or whether his own logic told him that the unlit convoy had moved off into the darkness. What did disturb him was the sudden flare of an incoming message over the radio link, which appropriately underscored the seriousness of the situation. Hammond again: "Confirmed Early Annandale now in Kunetra. Imperative you destroy her before she has a chance to destroy you. Suggest her assassination take absolute priority over all other activities, else you are lost."

He never slept, did not know what sleep was: his kind of creature had no need for recuperative slumber. Nonetheless he was used to a period of relative inaction between dusk and dawn, when the only eyes he used were those concealed in lighted rooms occupied by the garrison. This night was different. He ignored the lighted rooms and began to hunt with blind eyes through the dark recesses of the city. Nothing. The ambient light was far too low for his sensors to begin to resolve the scene, and unless somebody showed a light in one of the vehicles he must lose them completely. He lost them. Not even a lighted cigarette tip had betrayed their passage. Now Early was somewhere in the city —his city—and he was able to protect himself no more.

What could she be doing?

With something akin to mechanical desperation he plotted all the likely

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routes which the group could have taken and estimated the probable distance they might have traveled in the dark. Then, for the first time in his existence, he expended one of his precious road-mines without having a target surely in his sights. Even as he did so he realized the move was a mistake. The mine was under a major baulking-block, and sixteen peripheral cameras and the control circuits to a large number of his own arms went out at the same instant. Nonetheless he used the illumination of the flare to scan the road simultaneously for the half-tracks. Nothing. Early had tricked him. His only gain had been to start a fire in one of the buildings which enabled him to keep that part of the road under continuous surveillance.

Where now? Either he had underestimated the speed of the convoy and Early had already passed that point, which was unlikely, or else she had taken a different and less obvious route. Along part of a parallel road he had an automatic rapidfiring gun set to intersect the traffic lanes. He fired off the whole magazine and watched the bright fire of the tracers travel the whole distance without striking anything until they spent their force against a distant wall. He had wasted the usefulness of the armament but gained some information. Of the four possible routes, Early had not used two. The search was narrowing, and he began to feel he still had a chance of winning. In this he was aided by the fire started by the road-mine, which, spreading rapidly through some timbered buildings, was beginning to light the sky by reflection from a dense cloud of drifting smoke.

Dimly, a group of his external cameras began to start imaging again, and he threw himself into the task of examining every area from which he could get a picture, however poor the quality. Then he felt he had her. Having penetrated far more deeply into the city than he had calculated, three half-tracks were drawn up outside a large white building, formerly a government office. He had a camera in every office in the building, and several on the stairs and larger halls. Also, he had an extensive range of traps and single-shot weapons with which he could dispense death to anyone incautious enough to wander into range. He felt his confidence returning. For a supposed expert in the field, Early had chosen a remarkably imprudent venue for her trial of wits and strength.

Immediately, he scanned all the cameras in the building, confident that Early and her group had gone inside, but unable to understand how they had done so without using any form of light. His sensors told him nothing, even though now and then one of them began to image weakly in response to the glow from the fire entering through a window. Then he examined the scene outside again. The half-tracks were still there, but there was no sign of the recent occupants. Ergo, they had to be inside.

Early, he considered, was a clever one, but not clever enough to match him. She had made a serious mistake, and he was determined that for her it would be a fatal one. There was enough light now in the sky outside for him to be able to detect the movement of the half-tracks if she came out and tried to

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get away, and he had mines and weapons in the road and buildings sufficient to cover most of the available exit routes. If she stayed inside the building he need only await the coming of morning to be able to locate her and then bide his time until she came into range of one of his weapons. Then he would destroy her, and relative peace would return to Kunetra.

A message from Hammond again, the communication coming in as a scream of fast Morse, emphasizing its urgency. "Early known to have quantity of infrared head-sets which enable her to see in darkness. She can move at night anywhere in Kunetra without your knowing, because she can see where you are blind."

The message was timely, informative and disturbing. It explained how the half-tracks had been able to penetrate so deeply into the city without detection, and threw some doubt on whether she had actually entered the building at all. Shadowed from the light of the fire by the clustered buildings all round, she could easily have walked away and now be anywhere else in the whole city—his city. He arranged a frenzied scan of all the exterior sensors available to him and came up with nothing new. Only in the area of the fire could he see anything at all, and then only dimly. Now he was beginning to know for sure just how this terrible woman had earned her reputation for being unbeatable. How could he ever find peace while Early was in Kunetra?

Just as disturbing was the realization that he had lost his mastery. Ever since his first moment of consciousness he had been undisputed overlord of the city: to the humans a barely-tangible omnipresence, all-seeing and swift with vengeance. Now Early had changed all that, and it was she who was directing the pattern of play. She MUST be destroyed, and quickly, else there could be no more peace left to him.

Then suddenly he had her! A small and flickering glimmer of illumination in one of the offices in the government building gave him just sufficient light to get an image from one of the cameras. There was Early, moving slowly across the room, and there was a smile on her face. The source of light, probably a match, was extinguished suddenly, and for a few seconds he could see nothing. Then a new match was struck with a bright initial flare, and he could see her again, still moving, and now very near the projection line of one of his weapons. If only the light held . . .

The light did hold, though he was torn between the decisions to fire prematurely in case he lost the uncertain scene or wait until he was sure she was dead-centered in the sights. He waited and had the gratification of seeing the sharpened steel barb, propelled by an explosive charge, penetrate her precisely. Then the wan light failed again.

He concentrated all his attention on that one camera, waiting for the light to come again, and when it did so he experienced the nearest a machine can come to a feeling of relief. Early was pinned against the wall with the barb straight through her chest. Curiously she was still smiling, but that did not alter

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the fact that she must certainly be dead. He had won, and with a relaxation of the tensions he felt a touch of the promised peace.

However, it was a peace suddenly shattered as a light flared in another room and again the recognition patterns screamed the identification of Early. Impossible! He hunted back to the first camera and there she was still pinned against the wall. Crisis! Could there have been two Earlys? Or did she have some way of replicating, in which case he was fighting a battle he could never possibly win. Nothing in his backup or orientation files suggested that replication was possible, but neither did they suggest it was impossible. This he would have to decide using his own observations and logic. He waited for the opportune moment and killed the second Early by firing the whole magazine of a rapid-firing gun.

Almost immediately a light flared in yet a third room. . . .

He was not exhausted: his kind of creature had no knowledge of the animal sensation of exhaustion. Rather he had reached a condition of knowing, by every application of the logical process, that he could not possibly win. All night he had been taunted by laughing Earlys, and each one he had destroyed when he had the chance. Yet they continued to come in a seemingly endless supply: no matter how many he destroyed, yet another was always waiting for him in the next room or hall or corridor. After a while he understood that it was impossible to kill her. All his weapons could do was to fix her image at that point, but the rest of her escaped somehow and began to haunt him from a new angle.

With the coming of dawn his cameras

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had shown him that there was at least one Early in every office, and in the great council hall they appeared to stare down from every wall and be entering every door. Just before first light the soldiers had returned to their half-tracks, and he had let them go, because plainly they did not have Early with them. They had left perhaps a hundred of her dreadful patterns behind them in the building, and she was obviously not afraid of remaining in the corridors alone. He quite literally had only one weapon left in the whole building, and though he had her smiling image in the weapon sights he forbore to use the tiny charge of energy needed to make it fire. It was pointless. No barb or bullet or explosive charge could touch her. That much he now knew with an utter certainty.

With the first rays of the sun he disengaged himself from the contact and winged his visual way through old Kunetra, flying through the *souks*, and on between the Roman columns. In the Great Mosque he halted his metaphoric journey, hoping something in the atmosphere would bestow on him a sense of the peace which was all he really sought, but the sojourn was in vain. A visual flight around the amphitheater was equally distracted, and he kept missing the correct camera sequence to give him the impression of uninterrupted motion. In the space of a few short hours Early had robbed him of his mastery, taken over his city, and proved completely indestructible. He could find no peace while she remained in the city, nor was it within his powers to get rid of her. His purpose was destroyed.

As if to confirm this conclusion, another message came in from Hammond in screaming accelerated Morse and was interminably repeated, as though it had been recorded and run on an endless loop of tape. "You are lost . . . You are lost . . . You are lost . . . You are lost . . . "

In a sudden crisis of indecision he hurled the focus of his attention back to a view of the WarTech vans on the hillside. Early was there, as he had known she would be, and was seemingly untouched by her night of fragmentation. She was sitting on the steps of the van laughing with her companion, as though the events of the night had been simply effortless and amusing. His builders had promised him peace when the job was finished. Now that Early had so thoroughly beaten him from the game there was no more of the job that he could do. This was checkmate, and he had lost. Therefore his task was finished, and he could have his peace . . .

The explosion deep inside the mountain ripped a hundred yards of solid rock from a cliff face and gave a staccato report which startled everybody in the city. Maidment raised his eyebrows speculatively. It would take weeks of dangerous and careful testing before they could finally be sure that the killer-complex of Kunetra was no more, but the coincidence of the timing of the explosion with the transmission of his own last message was highly suggestive.

Meanwhile, deep in the heart of the city a shaft of sunlight, moving imperceptibly slowly across an office floor, began to illuminate the large, shattered photographs of Lieutenant Annandale, and the sticks and strings by which even her photographic image had been manipulated by a master puppeteer and one of the best liars in the business. ■

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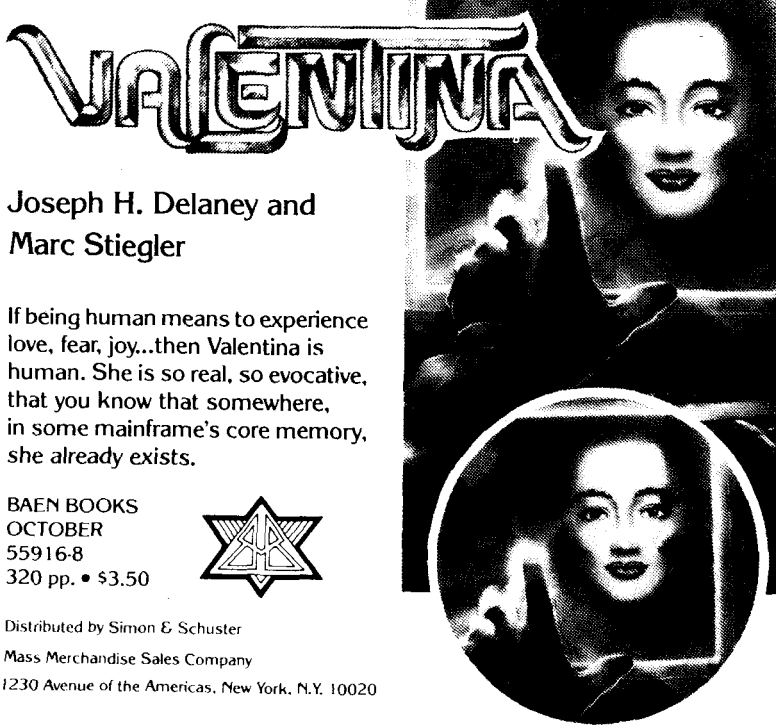

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Alan Vaughan

TOWARD A TECHNOLOGY OF PSI

A young field of research
is, by definition,
hard to evaluate.
When its subject matter
seems to show radically unfamiliar
behavior and evokes
strong emotions, it's even harder.

In the one hundred years since parapsychology began with the founding of the Society for Psychical Research in London in 1882, it has been inching its way toward control of psi (psychic) phenomena: an emerging technology of psi. Or so it appears to some workers in the field.

Others feel frustrated that psi experiments do not work a hundred percent of the time. Among them is Robert G. Jahn, who is Dean of the School of Engineering/Applied Science at Princeton University. In a 34-page paper published in the February 1982 *Proceedings of the IEEE* (Institute of Electrical and Electronic Engineers), "The Persistent Paradox of Psychic Phenomena: An Engineering Perspective," Jahn reviews the history of the field and details some impressive experimental work in psychokinesis (direct influence of mind on matter) and "remote perception" (distant psychic perception) being conducted by researchers at Princeton.

"Without question," comments Jahn, "the dominant experimental frustration in this field is the inability to replicate on demand previously observed paranormal effects, not only at other laboratories, but even in the original facility, using the original participants, under apparently identical circumstances."

Down the road from Princeton University is a private institute, Psychophysical Research Laboratories, headed by parapsychologist Charles Honorton, who takes a more optimistic view. In

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a 1975 paper entitled "Has Science Developed the Competence to Confront Claims of the Paranormal?" Honorton compares the success rate of psychic experiments with that of psychology experiments published in their respective journals. Out of 139 attempted ESP experiments from the 1930s to the mid-1970s, 85 of them (61 percent) were statistically significant—giving odds against chance of at least 20 to 1. The combined odds against chance for such a series of significant experiments are astronomical.

By comparison, experiments published in the *psychological* journals repeated earlier findings at the rate of less than one percent.

Surprisingly, then, the main effects of psychical research stand on far firmer experimental ground than those of psychology. Even if parapsychologists had thousands of unpublished experiments with nil findings, they would detract little from the strong statistical evidence for ESP.

So far the record holder in the *Guinness Book of World Records* is a subject at Hunter College in New York: she guessed ESP cards so successfully that it could happen by chance only in 10^{700} times of doing such experiments. That number is so large it would take ten lines just to write out!

Perhaps the difference in the views of Jahn and Honorton comes from their backgrounds. As a scientist in physical realms such as engineering, Jahn expects experiments to be replicated at every trial, whereas a psychologist or parapsychologist is happy when he gets significant results more than half the time. Yet Jahn and Honorton would agree that some researchers are consistently unable to get results. They are dubbed "psi-inhibitory" experimenters. Other experimenters show a consistent tendency to get positive results and are called "psi-conducive" experimenters. Differences in their track records show up even when the two types of experimenters do not meet their subjects but merely check targets.

Theorizing that these experimenter differences arise from inherent personality characteristics, researchers Gertrude Schmeidler and Michaeleen Maher of the City College of New York asked groups of psychology students to view videotapes of both kinds of experimenters and rate them on a five-point scale on a number of personality characteristics. The students knew nothing about the experimenters and could not even hear what they said on the videotapes since the sound was turned down. By simply observing their nonverbal behavior, the students rated the psi-inhibitory experimenters as being far more tense, cold, rigid, overconfident and egoistic. The psi-conducive experimenters were rated as being more enthusiastic and flexible. These characteristics, derived from two analyses and being highly significant statistically, give us a way to predict the success of potential experimenters: simply observe their nonverbal behavior. If you want positive results, pick the enthusiastic and flexible types. If you want to prevent psi, pick the cold, rigid, egoistic types.

Dr. Schmeidler had earlier paved the

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way for a prime indicator of success among subjects, and this would probably apply also to experimenters. Believers in ESP score positively, whereas disbelievers score negatively. This difference held up in 13 out of 17 experiments. Combining what we know about personality and belief gives us a surefire way to prevent psi: Enlist the aid of a cold, rigid, egoistic skeptic.

Of course we are more interested in obtaining *positive* results. Two physicists at SRI International (formerly Stanford Research Institutue) in Menlo Park, California, have developed protocols for obtaining psychic information from subjects about the unknown location of a remote experimenter—termed "remote viewing" or "remote perception." Publishing their results in 1976 in *Proceedings of the IEEE* and in their 1977 book *Mind Reach*, Harold Puthoff and Russell Targ reported that with over a hundred subjects, they obtained success with two thirds of them. Many of their subjects had no prior psychic experience, and some were even skeptics.

The basic experimental design requires the subject to report his mental imagery for 15 minutes in an attempt to describe the locale, chosen at random, where a remote experimenter is recording his observations and taking a photograph. Independent judges are given unedited transcripts, which they attempt to match against the locations or photos. Usually there are from four to eight locations in a target pool against which the judges make their rankings from best match to worst match.

In the technical volume *Mind at Large* (1979), edited by Charles Tart, Puthoff and Targ, the SRI researchers report on 51 experimental trials in remote viewing which yielded odds against chance of 10^9 to 1. They also reply to numerous criticisms made by skeptics.

The most compelling reason for believing the SRI work to be genuine is that it has been repeated a dozen times by other researchers at several labs. The 1982 Jahn paper, for instance, summarizes 146 remote perception trials done in Chicago and Princeton; their statistical significance is on the order of a 1,000 to 1. About 20 percent of the Chicago-Princeton work by Robert Jahn and Brenda Dunne yielded direct hits. In one remarkable series of 24 trials in Chicago, evaluated in a sophisticated method devised by the Princeton group, the odds against chance reached 10^8. Important to those who argue that ESP is a universal latent talent, none of their subjects had prior psychic experience.

A major insight gained from this work is that the right brain hemisphere (nondominant) becomes dominant in psychic functioning. The logical, left hemisphere, center of analytic thinking, must be suppressed. Therefore the researchers say to their new subjects, "Tell us what you *see*, not what you *think*." Visual imagery, feelings, colors, shapes, contours tend to be correct; names, numbers, functions tend to be wrong.

To get the flavor of these experiments, here are four attempts by photographer Hella Hammid when she first tried to foresee where the remote experimenter, Harold Puthoff, would be sent by random choice. This was the first precognitive remote viewing experiment at SRI:

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1. "Some kind of congealing tar, or maybe an area of condensed lava . . . that has oozed out to fill up some kind of boundaries. (Puthoff arrived at the Palo Alto Yacht Harbor to find it filled with mud.)

2. "A formal garden, very well manicured." (Puthoff visited the formal garden at Stanford University Hospital.)

3. "A black iron triangle that someone had somehow walked into." She heard a "squeak, squeak about once a second." (Puthoff went to a child's playground and amused himself on a swing shaped like a triangle. It squeaked.)

4. "A very tall structure located among city streets covered with Tiffany-like glass." (Puthoff visited the Palo Alto City Hall, resplendent with its glass windows.)

Those descriptions enabled the independent judges to rank all four transcripts as direct hits.

As Jahn notes, "The time of the perception effort need not coincide with the time the agent is at the target. Perceptions obtained several hours, or even days, prior to the agent's visit to the target, or even prior to selection of the target, display at least as high a yield as those performed in real time." That is, time seems to be irrelevant in remote perception.

If present statistics hold up, most of those who try to do precognitive remote perception should succeed. Intelligence agents should find this a most helpful adjunct to their data-gathering techniques.

Has anyone ever achieved perfect accuracy in obtaining information by ESP? In a 1966 report published in the *Journal of Parapsychology*, Milan Ryzl, now of San Jose, asked his talented subject Pavel Stepanek to make thousands of guesses (green or white) at a binary color code for a 15-digit number. Averaging about 1,333 guesses per digit, Stepanek made a total of 20,000 guesses in 50 hours. His repeated guesses were 62 percent accurate; but when Ryzl took a majority vote of the guesses for each digit, he pushed Stepanek's final accuracy up to 100 percent—all 15 digits were transmitted without error. Odds against chance, of course, were 10^{15} to 1.

How about psi communication with the future? Suppose I want to predict if a missile will be in a certain silo at a certain time in the future. If I want to insure that my information is at least 26 percent above chance expectation, I will call on the services of James C. Carpenter of the University of North Carolina's psychology department.

Neither Carpenter nor his student subjects claim any special psychic ability. But what little ESP they may have can be enhanced and amplified by techniques developed by Carpenter and others over the years. In his 1981 paper, "An Elaboration of the Repeated Guessing Technique for Enhancing ESP Information Efficiency," Carpenter demonstrated with nine groups of students that small deviations from chance guessing in a binary (yes-no) situation with future targets can be teased into large extra-chance information retrieval. If a student's scoring was sampled as being below chance, Carpenter simply chose the opposite for the message guesses; of course students with

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above-chance sampling kept their positive predictions. Each subject generated a number of guesses for the same targets, and the majority vote was taken as the final prediction. If there was a tie, no prediction was made.

Out of 105 majority vote decisions, 80 were later proved right and 25 wrong. Carpenter's subjects were hitting at 76 percent accuracy. In the first study, the individual hitting rate was 54 percent but the majority consensus reached a high of 85 percent accuracy. At those odds, it would ill behoove a government to try to hide missiles by shuttling them between silos.

Other experiments with group ESP show that consensus techniques can raise the accuracy of psychic responses far above chance level. In 1970 I published a simple technique for eliciting ESP impressions from group members in attempts to describe an art print being sent by a telepathic agent. The group members individually rank a target pool of five art prints against their imagery. In a pilot experiment three out of six subjects ranked the target picture as their top choice. The group consensus was arrived at by majority vote.

This technique was used with considerable success by two Argentine researchers, J. Ricardo Musso and Mirta Granero, in a 1981 paper read to the Parapsychological Association. Using students in their parapsychology classes as subjects, the researchers asked them to generate ESP impressions of an unknown target picture being sent by a telepathic agent. The students individually picked the correct target picture 30 percent of the time, hitting 10 percent above chance. But when they voted for consensus, their group hitting rate shot up to 53 percent—33 percent above chance.

In a group ESP experiment published in 1973 by Gertrude Schmeidler and Jane Goldberg of the City College of New York, a psychic teacher and his students simultaneously attempted to describe a target group of unknown persons when the lead psychic held some concealed writing of the target people. The lead psychic's statements were judged blindly by the target people and found to be accurate at the level of 20 to 1 against chance. But when the students' statements were compared with those of the lead psychic, the researchers found that the others picked up mainly the correct information and not the errors. The consensus statements proved accurate at the level of 200 to 1 against chance.

This tenfold increase in accuracy suggests that this group ESP technique may prove to be a valuable contribution to the emerging technology of psi. As the lead psychic in that experiment, I theorize that my field of psychic influence expanded during times of true ESP functioning and affected my nearby students, with whom I had rapport. Together we were able to put together far more pieces of the psychic puzzle than any one of us could have done alone.

Beginning in 1977 a research group in Los Angeles, The Mobius Group, headed by Stephan Schwartz, developed psychic consensus techniques for use in archaeology. Project Deep Quest used several psychics to locate a previously unknown wreck on the sea floor off

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Catalina Island. Using a research submarine, the Mobius crew discovered the specific objects described by the psychics.

In 1981 Schwartz presented to the Parapsychological Association another example of psychic consensus techniques. Two psychics Schwartz had taken to Egypt were asked to locate an unknown structure in what is now an abandoned area named Marea. The experiment began when one of the psychics correctly described the location, surface geography, and major remains to be found at Marea—while standing approximately eight kilometers from the site. Schwartz then asked the psychics independently to pinpoint some interesting target location and describe what would be found underground. Both agreed on a single area and one psychic staked out the outlines of what he said was a buried Byzantine structure. The other psychic described in detail specific objects she predicted would be found.

When asked to comment on the psychic data, archaeologist Fawzi Fakharani of the University of Alexandria said the psychics could not possibly be right. If anything was to be found, it would have to be Roman, he insisted. Both he and Schwartz knew that a magnetometer survey of the area showed nothing. The dispute was put to test by digging. The Byzantine structure was uncovered and proved the psychics correct in many particulars. As Schwartz noted, "There was no need for statistical analysis. Either you find it or you don't."

The Marea experiment was part of a larger study called the Alexandria Project, which Schwartz has reported to several archaeological societies and recently published as a book (*The Alexandria Project*, Eleanor Friede Delacorte and Delta.) Notable among their psychic finds now sunk in the Alexandria harbor are the palace of Marc Anthony; remains of what may be the Ptolemaic palace complex described by the ancient geographer Strabo—home to all the rulers of that dynasty (323–30 BC), including the last, Cleopatra; and remains of the famed lighthouse of Pharos.

A critic has called this "cocktail-party archaeology" but major finds that have eluded searchers for centuries cannot be so lightly dismissed. Schwartz calls the conditions for his experiments "triple blind" since no living person knows the answer until the archaeological dig—or dive, in the case of the Alexandria finds—proves the psychic consensus data right or wrong.

Since the Alexandria Project required almost half a million dollars to carry out—much of it to provide a comprehensive filmed record of the experiments—the Mobius Group cannot afford to make mistakes. At those prices, the psychic consensus must be reliable. If the Mobius Group has shown the way to achieve a technology of psi, it has also shown that such developments—especially in their early stages—can be expensive. The funding for that single Mobius project nearly equals the amount of the combined annual budgets of the 13 major parapsychology laboratories in the United States.

The government science funding agencies have, with a few notable exceptions, refused to fund parapsychol-

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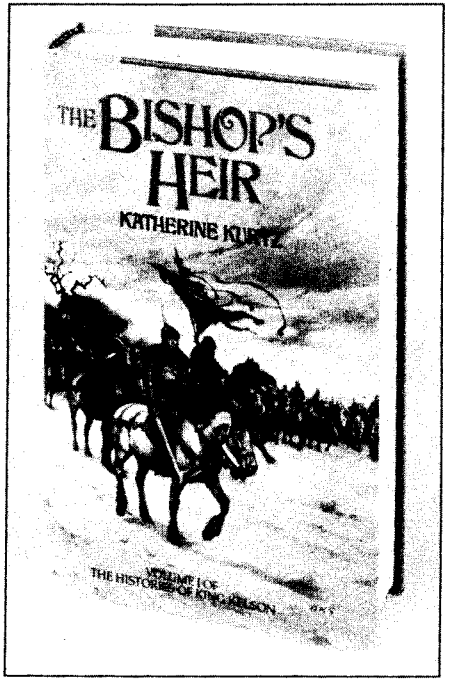

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ogy. The situation may be changing, however, if a recent report to Congress by the House Committee on Science and Technology has any influence. In the June 1981 *Survey of Science and Technology Issues Present and Future*, this recommendation appeared:

> Recent experiments in remote viewing and other studies in parapsychology suggest that there exists an "interconnectiveness" of the human mind with other minds and with matter. This interconnectiveness would appear to be functional in nature and amplified by intent and emotion.
>
> There is no certainty as to what results will emerge from basic and exploratory research on the physics of consciousness now under-way. In the area of national defense, there are the obvious implications of one's ability to identify distant sites and affect sensitive instruments or other humans. . . .
>
> Thus far, the quality of research . . . has been lacking due in part to low funding. Given the potentially powerful and farreaching implications of knowledge in this field, and given that the Soviet Union is widely acknowledged to be supporting such research at a far higher and more official level, Congress may wish to undertake a serious assessment of the research effort in this country.

If that recommendation is to succeed in helping fund parapsychology, it must be accompanied by a massive education effort. Most scientists, including those who rule on funding proposals, have little opportunity to learn of the research findings of parapsychology. The four major English-language journals—*The Journal of the American Society for Psychical Research*, *The Journal of Parapsychology*, *The Journal of the Society for Psychical Research* (London), *The European Journal of Parapsychology*—have tiny circulations. The annual proceedings of the Parapsychological Association, entitled *Research in Parapsychology*, are available in few libraries.

Although the Parapsychological Association, with 280 member scientists around the world, has been affiliated with the American Association for the Advancement of Science since 1969, the official AAAS journal, *Science*, refuses to publish positive research findings on psychic phenomena because "Most of our readers do not believe in ESP."*

In 1979 *Scientific American* published the news that the distinguished physicist John Wheeler was calling for the expulsion of the Parapsychological Association from the AAAS. Wheeler accused the parapsychologists of practicing "pseudoscience." When asked for an example of such pseudoscience, he repeated an inaccurate rumor about J. B. Rhine—and was forced to make

*The quote comes from a letter from a *Science* editor to parapsychologist Charles Honorton in response to a submitted paper which was rejected. The paper was later published in the *Journal of the American Society for Psychical Research*, April, 1975, "Experimenter Effects in Extrasensory Perception," by Honorton, Ramsey and Cabbibo. An appendix reprints the correspondence between Honorton and *Science*.

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a public apology in a letter to *Science* (July 13, 1979). However *Scientific American* did not print that news, leaving their scientist readers with the impression that Wheeler's charges were accurate.

By far the most vocal critics of parapsychology have been members of the Committee for the Scientific Investigation of Claims of the Paranormal (CSICOP), who have waged a media crusade against parapsychology. To the layman and scientist alike it appeared that CSICOP was finding serious faults. But another picture began to emerge when Marcello Truzzi, editor of their journal, resigned—charging the committee with "witch-hunting." Cofounder Dennis Rawlins published (in *Fate*, October 1981) an account of internal controversy which at the very least raises interesting and disturbing questions.

The doubts CSICOP planted do not die easily. The will to disbelieve—to protect the tender mind from painful facts that threaten a traditional belief system—is still strongly entrenched in the Science Establishment. And that is partly due to lack of reliable information. But when a quasi-religious (dis)belief system pervades major funding institutions and publications as a policy, it becomes not only unscientific but threatens the very pursuit of science.

If a century of psychical research has inched toward understanding and applying psi phenomena, it has been in part because of a century of criticism—the insightful kind, not the emotional debunking. Double blinds, randomization of targets, sophisticated use of statistics, fraud-proof experimental designs are some advances spurred by thoughtful criticism. And doubtless new criticisms will also prove useful.

The overall result of such criticism has been to strengthen the investigative process of psi. It has also made it more expensive. A comprehensive report on the state of the art of psychic technology appeared this January on a one-hour Nova special on PBS. Most experiments work; some do not. Yet there is at least one remarkable case of a murder being solved with psychic help provided by the Mobius Group. Other psychic uses may not be far behind.

Major funding for parapsychology has the potential for bringing the technology of psi from the pages of science fiction to the lives of everyone.

As I prophesy in my book *The Edge of Tomorrow*:

"On the forefront of the future lies the most powerful technology ever devised: the technology of human consciousness." ■

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ABOUT THE AUTHOR

Alan Vaughan is the author of five books on parapsychology, including *The Edge of Tomorrow*. He formerly edited *Reincarnation Report* magazine and *Psychic* magazine and has published over a hundred articles on psychic phenomena.

As a researcher turned psychic, he works as a consultant to The Mobius Society and is developing a computerized training system for precognition.

He is affiliated with the Parapsychological Association, holds an honorary doctorate in parapsychology, and is considered the most accurate predictor in the records of the Central Premonitions Registry.

● You have . . . lived through a time when all issues have been polarized; when positions are taken at either end of the spectrum, and no place in the center has been provided for a philosophy. And in truth, probably that's where more truth resides: closer to the center. I wonder if after all there exists one issue, one disagreement, one major controversy, that doesn't have at least something to support and sustain on either end.

Rod Serling

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On Gaming

Dana Lombardy

In the September, 1983 issue of *Analog*, I reviewed *Star Trek: The Role Playing Game* by FASA Corp. (The entire line can be seen at your local store, or you can obtain a catalog direct from Box 6930, Chicago, IL 60680.) Since then, a number of you have written to ask for an update on the *Star Trek* game project.

A lot of material has been produced by FASA in the past year, and much of it will appeal to science fiction readers who don't play SF games. This is because of the quality of the material and its presentation in the numerous modules and supplements describing the *Star Trek* universe.

There are two elements in FASA's series—the role-playing game and the board game. The role-playing game (rpg) is based on the television series. Originally released at the same time as the board game, the rpg has since been revised and re-issued separately. A chief design problem was how to make the role-playing adventures interesting since they are based on familiar shows. The fact that there *are* some genuine surprises even in well-known episode-adventures speaks well for the design team that created this rpg.

Since its release, a number of interesting modules have been published to support the game. Besides the adventures mentioned above, books on alien races (both enemies and allies of Star Fleet and the United Federation of Planets), ship recognition manuals, ship deck plans, and 1/3900 scale metal starship models are available. FASA plans major new releases to coincide with each new movie.

The most impressive of these modules is *The Klingons*, a sourcebook and character-generation supplement about Star Fleet's archenemies. The heart of this boxed supplement is a 64-page illustrated book which outlines Klingon characteristics (skills and physiology, weapons and equipment, ranks and military organization) and the history of the Klingon empire, including religion and culture. There are even notes on Klingon epithets so a player can really assume the identity of a Klingon when playing the game.

If you've ever wondered why the Klingons in the *Star Trek* movie looked different from those portrayed in the TV series, you'll find the reasons in this book. Two adventures are included with the supplement. One is very short and involves a group of highly-trained Romulans who have escaped their cells on a Klingon D-7 Battlecruiser and are attempting to seize control of the vessel. As the Klingon D-7 commander, you must stop them and prevent major damage to your ship.

The other adventure is more elaborate and revolves around Klingon political intrigue on a remote planet. As a Klingon starship captain, you are ordered to investigate native unrest on the planet. Because of family connections, the local Klingon governor of the planet cannot simply be replaced. Instead, you must decide how to investigate the matter.

As a Klingon, you want to do what-

(continued on page 145)

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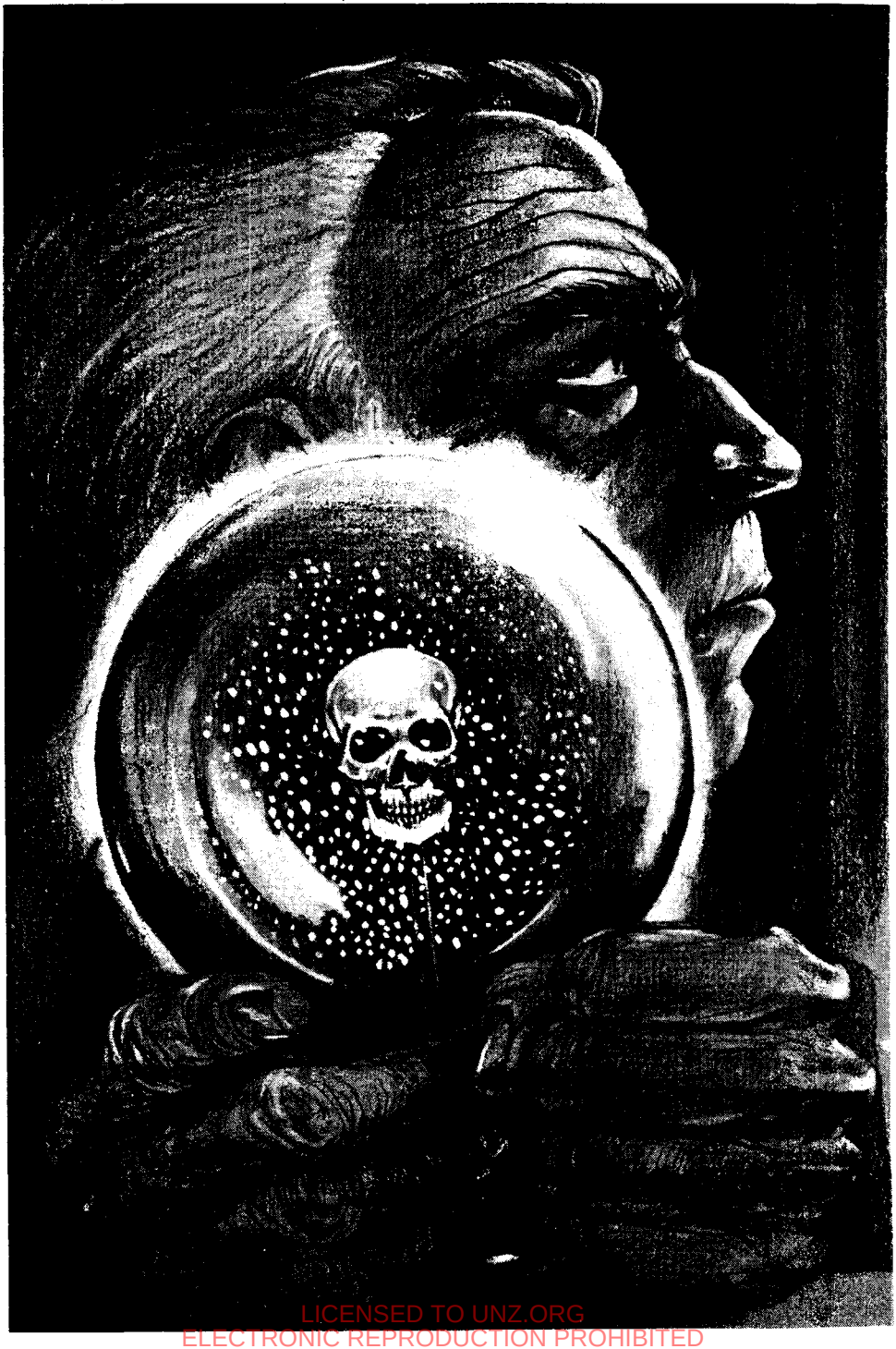

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Judy Mitchell

Eric Vinicoff and Marcia Martin

WINTER SNOW

The tragic difficulty with solving humanity's big problems is that they depend, ultimately, on little actions by individual human beings.

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Every so often one of the tiny ersatz snowflakes sparkled as though reflecting an errant beam of moonlight. But there wasn't any moonlight, only the softened lamp illumination of Premier Kirinski's personal office, and beyond the curtains the early morning sun raising mists from the stone-strong Kremlin walls.

The snowflakes drifted, seemingly carried by a gentle breeze, around the dark ball in the center of the crystal globe. The globe was twelve centimeters across. A slender rod of the same dark metal rose from the globe's base to hold the ball in place. The base was set in a black plastic stand.

The globe was on the corner of Premier Kirinski's desk.

He sat rigidly, his back well away from the chair's padding, and stared at the globe. He had just come from the Central Committee meeting, and he would return to it shortly. But he had chosen to talk to the American President here. (Though of course the committee members would be watching and listening to the conversation.)

The snowflakes were purposeful in their travel, deliberately circling, never touching the ball or the crystal. They never fell. Unlike the snows of Kiev where he had been a happy child too many years ago. Or the knife-edged blizzards during the street-to-street fighting in Leningrad and later in Berlin. . . .

He stabbed a button on the intercom impatiently. "What is delaying the call?"

"My apologies, Premier," Colonel Gurkoff said diffidently. "We have not used the picturephone equipment on the special line except in tests. The technical difficulties will be corrected in a minute or two."

"See that they are, Colonel."

The notes for his discussion with the American President were open in front of him, but his gaze returned to the globe.

His father was a tall presence amid the snowflakes, calling him into the house to finish his chores. *Yes, father, I have done many chores for my family, my country. The doctors tell me I will be joining you soon, perhaps before the year is out. But I have this last and most important chore to do. Then I can warm myself by the fire and rest.*

The company name, Omutami, was written in fine silver script in the globe's base. The Japanese were very good at devising such clever toys. Many of them had been sent as gifts to influential persons in an effort to secure an import license. Of course the license had not been granted; grain came before toys. But he had kept it because it was . . . clever.

The Nazis killed you, father. They laid waste to our country and butchered our people, as other invaders did before them. Today we are hemmed in by enemies who would bring the horror upon us yet again if we weren't strong in arms and determination. China. Western Europe. But above all America.

The battery in the base would keep the snowflakes moving—how long? He would have to have replacements purchased from the Japanese company. Much effort to keep a toy working, but few things gave him pleasure now. His

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body was old, a frail and failing container for his still-strong dedication to his country, party and people.

The Americans are a worse threat than the Nazis. Not as evil, but powerful and willful children. Governed by the whim of the mob. One day they wish to live in peace with us; the next they hate and fear us. Who can know what they will do next? They corrupt other nations and turn them against us, while squandering the world's resources in capitalistic excess. Their atomic weapons are aimed at our cities and military bases. No more! We cannot go on as hostages to the actions of a decadent people!

The intercom buzzed. "The call to President Nivling is ready, Premier."

He sighed, and dragged his eyes from the globe to the picturephone. The decades of wishing, the years of hard work; all for this moment. A supreme moment. He would at last be the savior he had dreamed of being ever since the fear-clutched World War II days.

If he was mistaken . . . But no, the technicians and the military leaders and the party officials were all in agreement. Now was the moment. Any timorousness would let the great opportunity slip through his fingers.

The small screen flickered, then resolved into the head and shoulders of the American President. He was seated in a high-backed chair. No one else was in view, but his eyes revealed that others were present off-camera. With mild surprise the Premier recognized the darkened background as the Pentagon's Situation Room.

"Good morning, Premier," President Nivling said in his very bad Russian. His tone was somber, and he wasn't trying to hide his frown. He was also an old man, but stocky and overweight where the Premier was wiry. He looked like a successful, decadent capitalist—which he was—and foolish, which he definitely wasn't. An accomplished demogogue, brilliant but not wise, with the morality of a starved wolf. "It is morning for you, isn't it?"

"Yes, it is. You know why I have asked for this conference?"

"I have a pretty good idea."

"Then you know that the matter is very serious. Shall we dispense with preliminaries and discuss it?"

"As you say."

"I am sure your spies have kept you informed as to the progress of our project called Tsarina."

"Of course. Even a few details you weren't kind enough to leak to us." The President paused. "Some of my advisers are puzzled over why you haven't tried to keep it a better secret."

"And you, Mister President, are not?"

"Of course not, Premier. Because by its very nature you couldn't have hidden it even if you had wanted to. Plus you were giving us plenty of time to consider our options."

It was a pleasure to deal with an intelligent opponent. If only that intelligence could be directed to smoothing the way to the necessary future. "Naturally that meant taking some risks. Several of your sabotages delayed us substantially."

The President's brows rose in an exaggerated gesture. "Sabotages?"

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"Deny it if you wish. It doesn't matter now. The Tsarina satellites are in orbit and activated—as you must know, since we destroyed your missiles that 'strayed' too close."

The President didn't bother with another denial. He waited stoically.

"You had the technology to build the equivalent of Tsarina and maintain parity. But you squabbled over diverting money from your hedonism until it was too late. While we sacrificed to insure our security."

"Not that your citizens had any choice in the matter."

He was bored with such simplistic misconceptions. "You who confuse freedom with anarchy can hardly be expected to see the difference between discipline and oppression. Enough of this. I have called to tell you the realities of the new situation."

The President nodded slightly, as though hearing expected words, but otherwise showed no reaction.

"The particle beams from the Tsarina satellites can destroy missiles and aircraft in flight anywhere in the world, even cruise missiles or jets flying, as you say, down on the deck. You know this is true—you have observed our tests."

"You may be overly enthusiastic about your new ultimate weapon."

"Tsarina is a defense, not a weapon. We are now safe from the strategic nuclear weapons of hostile nations."

"I hope your sense of safety will help reduce the tensions between us. We have never wanted anything from you but peace."

He had to fight down a surge of anger. "We will have peace. We will have peace when no one can ever threaten us with war again. We are not going to sit idly while you develop countermeasures against Tsarina."

Some color left the President's ruddy cheeks. "You have some specific proposals?"

"We have specific demands; let's not mince words. I am telling you this privately so you can put the best possible face on it for your people. You will destroy all of your strategic and tactical nuclear weapons. You will stop all nuclear research, as well as research in certain other areas. You will withdraw your military forces to within your national borders, and reduce their number to an acceptable level. A detailed memorandum will be delivered tomorrow by our Ambassador. The other nuclear powers will receive similar ultimatums."

"Don't be absurd," the President said. "The United States isn't about to surrender based on a mere threat. If I tried I would be removed from office. I warn you, Premier; if you insist on starting a war, you will get more of a war than you expect."

His eyes wandered briefly to the globe. The snow had been bitterly cold during the scorched-earth retreat to Leningrad. He regained his concentration. "I am not threatening. If you don't destroy your nuclear weapons, we are prepared to do it for you."

"It's not too late to stop this, Premier. Have you really considered that you might be triggering the destruction of the human race?"

"We have given this matter a great

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deal of serious thought. I hope you will now do the same, and avoid senseless slaughter. If you haven't complied with the terms of the memorandum within forty-five days, our naval forces will begin by destroying your missile submarines. Then if necessary we will destroy your land-based nuclear weapons. Any retaliation on your part will be crushed and punished."

There was a pause by mutual consent. *Words. Just words such as anyone could say. But because I am who I am, my words are magical spells that can unleash devastation. How can such power lie in two withered old hands? How can I wield it so perfunctorily? If I believed in a god, I would pray for a bloodless victory.*

The President glanced off-camera and seemed to be listening to his unobtrusive earphone. Then he spoke. "Premier, because I know you are an intelligent and honorable man I had hoped my hard line advisers were wrong about your purpose. Unfortunately they weren't. So from the highest motives we are about to kill millions of people. *It is my duty to inform you that a state* of war now exists between our nations."

He held in a bitter chuckle. "Empty formalities won't change the facts. Time is short. May we please talk sense?"

The President looked even more pale. "Yes, time is short. It has almost run out. For over half a century we have lived with the balance of terror. But now you have opted for all or nothing. You win or we win, or maybe everyone loses."

He felt a sharp and totally irrational stab of uncertainty. *It must be a bluff. General Zierten is positive that they haven't developed a means of counteracting Tsarina.* "This isn't a debate. We are discussing very real matters."

"I know. But your demands are based on incomplete information. Please listen carefully. You will have to act at once on what I tell you."

It has to be a bluff. "Go ahead."

"You were right that our political climate kept us from building our own particle beam satellites. We realized the danger of that fact several years ago. What you didn't realize—because we did a good job keeping it secret—was that we were developing a weapon system impervious to your Project Tsarina."

"At the first sign of disease or chemical attack we will launch—"

"Nothing so unimaginative, Premier. The idea came from a Department of Energy project to develop an ultra-light weight power source. When we realized its potential and evolved our plans, the actual engineering was done in Japan in cooperation with their Secret Service. Aside from being very capable, they are excellent at maintaining security. Aren't they?"

"It is difficult to discover a weapon that exists only in your wishful thinking."

The President picked up something from his desk and held it so that the Premier could see it.

It was a crystal globe filled with whirling snow. "I see you have a toy like this one on your desk too. Beautiful, isn't it? Almost seductive."

He glanced furtively to reassure himself that his globe was still on the desk,

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and tried to hide his confusion. "You want me to believe this is some sort of weapon? You will have to do better. It was thoroughly scanned. It is nothing; a glass ball, some iron flakes, a battery and an electromagnet."

"Yes, that is almost exactly what it is. You spent billions of rubles to create a perfect defense against strategic delivery systems. So we used the postal system. Thousands of these toys were mailed all over the Soviet Union. Most are as harmless as they look, like mine here. But a few hundred—yours, for instance—are different."

He stared at the globe. The beauty of the swirling snowflakes had turned into a chill, ominous mystery.

The President went on. "The owners of these toys tend to keep them on their desks so they can enjoy them. In a few minutes the immediate vicinity of each special one will disappear. Government centers, military bases, key industrial plants and so on. Slash the head from a highly centralized nation and it dies. Your nation will then be partitioned at the Urals; NATO will occupy the west, China the east."

He felt himself slipping into the mad delusion, the spell woven by the President's words. "How does this miraculous weapon work?"

"Your globe is prettier than mine. Mine doesn't sparkle. But even in the hard vacuum inside the globes there are some air molecules that bump into the snowflakes. The snowflakes in your globe are iron of a unique and valuable sort. Crystalline antimatter iron. Only about an ounce, but $E=mc^2$ is a very long lever. A signal from here relayed through a satellite triggers the detonation."

He vaguely remembered one of the many briefs of scientific research proposals that crossed his desk. Something about producing antimatter with high-energy particle accelerator rings and magnetic containment techniques borrowed from fusion technology. But according to the brief, success was at least a decade away. Could the Americans possibly be that far ahead of his country?

His office door opened and Colonel Gurkoff rushed in. He started to reach for the globe, but the Premier waved him back sharply. In an old and tired voice he said, "If there were time to remove or defuse it, we wouldn't have been warned." *How many more are in Kremlin offices? Four that I know about.* "Aren't I right, President Nivling?"

The President nodded.

He studied the snowflakes. They looked very cold, cold as death. The blighting frost reached out to fill his mind and soul. "Leave me, Colonel."

"But—"

"Leave me, Colonel!"

Colonel Gurkoff backed out, his face a blank mask.

"Even if this incredible tale were true, why tell us about it? Why not go ahead and set off your bombs?"

The President leaned forward, earnestness showing in his bland face. "Isn't it obvious? We are standing on the brink, but we haven't jumped yet. Some of my advisers wanted a preemptive strike. As it is, I can only delay the

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signal for a few more minutes. But we can still avoid war."

"How?" He felt himself slipping inexorably toward acceptance of defeat.

"By restoring the balance of terror. You must destroy the Project Tsarina satellites right now. If you do, we will call off our attack. We will give you twelve hours to get all the toys to safe places before we detonate them."

The fear was plain in the President's expression now. Not fear that what he was doing would fail. Fear that it would succeed too well, and he would have to live with the responsibility. His eyes almost pleaded. The Premier had reached and held his high office by reading the truth behind faces. He saw it here.

Father, what have I done to our country? I have brought the horror down on us for the last time. Millions of our citizens will die, and foreigners will rule the survivors. "That is impossible. If I gave such an order based only on what you have told me, I would be arrested for treason and the order ignored. I must have proof to take before the Central Committee. And time."

"Damn it, man, you know I can't give you either!" The fear permeated his voice. "I am not trying to convince you to do anything! I am offering you the only chance I can to save your nation!"

He turned to the seldom-used communication console. As the President well knew, he did have the authority to order the immediate destruction of the Tsarina satellites. Of course he would then have to justify his decision to the Central Committee or be executed in disgrace. But that wouldn't be difficult—he would have them witness the safe detonation of the toys at the end of the twelve hours.

He couldn't do it.

For all his confidence in his own judgment, and his belief that the President was telling the truth, he had no real evidence. *I am a rational man, a practical man. I cannot act on a mere premonition of doom. Not in this ultimate test. If I don't destroy the Tsarina satellites and the President is telling the truth, I have murdered my country. But if I destroy them and he is lying, I have thrown away our victory. I must have verification. Absolute and undeniable.*

He looked into the white current of the globe. For what? The sign he needed? Escape? Simple certainties to draw strength from?

What he saw there was what he had to do.

A tragic necessity, martyring hundreds of Soviet citizens to the cause of national survival. But every other solution—blocking the signal, removing the toys, decentralizing military forces and so on—failed because of the time limit. For himself he felt no fear, only relief at having an honorable surcease from guilt.

"Can you detonate one particular globe and not the others?" he asked levelly.

"Yes. But for obvious reasons we can't give you time to witness and evaluate a demonstration."

"I realize that." *Not even time enough to arrange for a less important sacrifice.* "Please listen to the call I am about to make." He would have to act quickly, before the Central Committee and the

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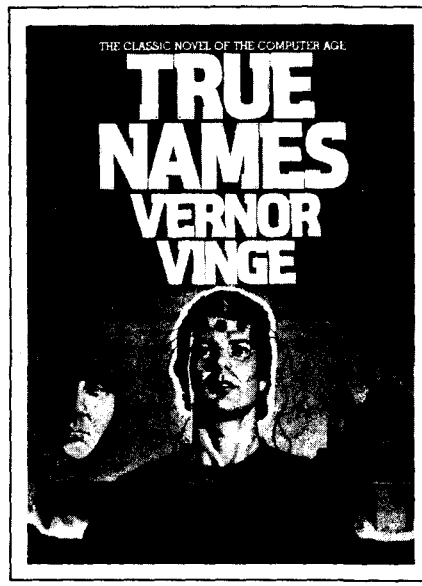

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KGB could overcome their shock and interfere. He leaned over the console, and activated the direct line to General Kosslov at the Baikonur Space Center. Seconds later the general's blunt features appeared in the tiny screen. A dull, unimaginative but very loyal officer who would slit his own throat if commanded to. "Yes, Premier."

"Copy the recording of my conversation with President Nivling—I am sending it now." He pushed the necessary buttons.

"We have it copied, Premier."

"Good. Now listen carefully, General. The survival of the Union of Soviet Socialist Republics depends on your obedience to the orders I am going to give you."

"I understand, Premier."

"Stand by to activate the destruct mechanism for the Project Tsarina satellites."

Shock ran across the general's face like an ocean wave. "Yes, Premier. But . . . may I ask why?"

"I am going to leave this line open while I finish my talk with President Nivling. If it goes dead in the next five minutes, it will mean the Kremlin is gone and the Americans have a weapon that will destroy us utterly unless Project Tsarina is ended. You will have three minutes to activate the destruct mechanism. Then you will inform General Vladisov in Leningrad of your action and transmit the conversation recording to him. Is that clear?"

It took a moment for the entire meaning to penetrate the thick peasant skull. Then: "Yes, Premier."

Vladisov. Yes, he will make a good leader for the difficult time ahead. He is younger, born into this new era of subtlety. He will master his anger, not lash out in retaliation and doom the world. He will be able to make the necessary arrangements with President Nivling.

"We are almost out of time," the President said in an urgent tone. "You must destroy the satellites now."

"Detonate my globe." *So easy to say. Just words without real meaning. Everything has become a move on the chessboard, even my own death.* "If you can."

There, it was done. Too late now for the KGB to cut the line or shoot him. He had depended on the inertia of their bureaucratic minds to provide the minutes he needed. He wondered if the KGB agents were hunting for the toys, evacuating the Kremlin, or coming to make him change his orders—all equally futile.

The President nodded to someone off-camera. "I see. I have come to know you well, Premier. I have a lot of respect for you. Now you are making me a murderer. Your murderer. Damn us both! We are supposed to be good leaders, not creating idiotic and destructive situations!" He took a long breath. "But if your General Kosslov obeys orders, you will have saved your nation."

"He will." He almost smiled as he imagined the panicked scurrying of the old fools of the Central Committee. *We will pay the price of the failure we wrought together, as it should be. The new leaders will hopefully learn an important lesson from it.*

He picked up the globe and stared at it. Something was wrong. The orbit of

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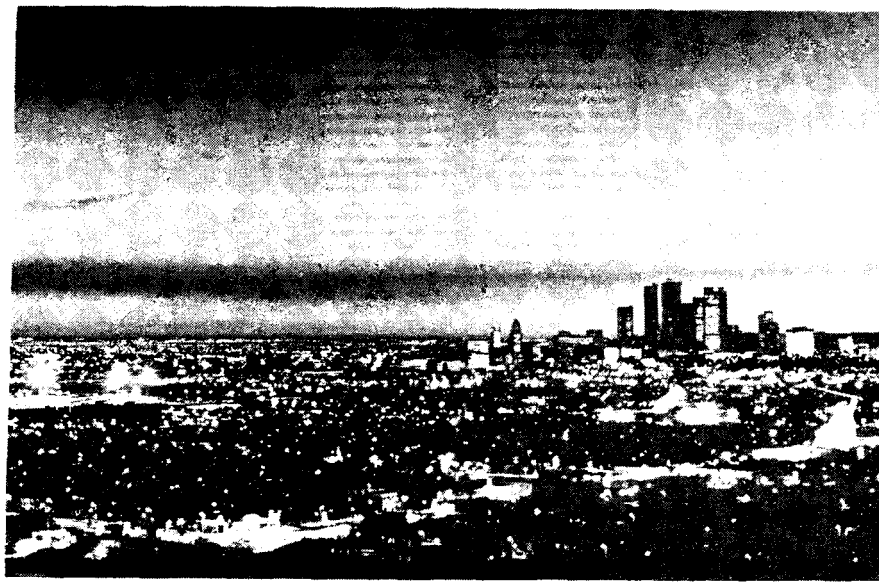
the moving snowflakes was descending. They were slowly dropping toward the bottom of the crystal.

Night's darkness was falling with this last snow of winter. Father was calling to him to come inside, to sit in the warmth by the fire, beyond all cold. To melt the guilt and failure that were jagged ice crystals in his blood. To rest.

The first of the snowflakes touched the crystal— ■



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Jay Kay Klein's biolog

When applied to Marcia Martin, the term "collaborationist" has only good connotations: she is the female half of the complete Yin/Yang circle making up the Martin/Vinicoff series of stories that have graced *Analog* since June, 1975. It all started in Santa Cruz at the University of California, when two students attracted to each other found they had more in common than most young couples.

She has lived mostly in the San Francisco area, and now lives just outside in San Jose—with a brief break in New York City. Reading science fiction started early, beginning with 19th and early 20th-century classic novels. Then she became a *Star Trek* addict. Her first effort with Eric Vinicoff (appropriately enough for two California college students) was a futuristic 16mm color film with sound. There were spies of the future, matter transformers, and bright blue aliens.

Eventually, Marcia secured a BA in History and went on to a workaday world that she notes has a lot in common with science fiction: writing advertising copy. She is currently Marketing Director of Reference Recordings, a San Francisco audiophile company that produces such high-quality products that its records are issued in 45 rpm. The eclectic catalog runs from Baroque through Romantic to Jazz and Way Beyond.

When writing with Vinicoff, she hashes out the plot with him, then she does the technical and historical research and he writes the main bulk of the story. Polishing is done together. Marcia prefers to work on stories touching the questions of future politics and economics. Both writers having strong backgrounds in history and political history; they find it fascinating to speculate how people will interact with each other in the future. Clearly, future ecology and biology will be major factors in humanity's hope for survival, and this helps form the setting of their stories.

It wasn't so many years ago that few women read science fiction and even fewer wrote it—and when they did, they used first-name initials as a disguise. Story content then was largely nuts-and-bolts engineering. Now, Marcia feels, women writers are doing some of the finest new work around. While every type of science fiction is being written by women (including, it should be noted, "macho masculine adventure"), she sees a trend toward exploring deeper human emotions and showing realistic character development in stories that also contain hard-edged science. With a bit of transposition, her advertising copy for hi-tech recordings could apply to what she sees in today's science fiction: "Our recordings represent the pinnacle of what it is possible to achieve with today's disc technology." Looking back, it's pretty obvious the state-of-the-art has progressed enormously—not only in fields of technology, but also in literature centering on technology. ■

Marcia Martin

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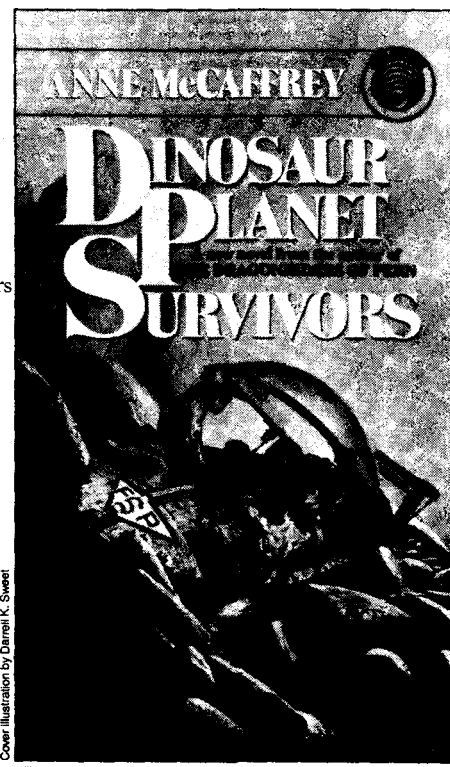

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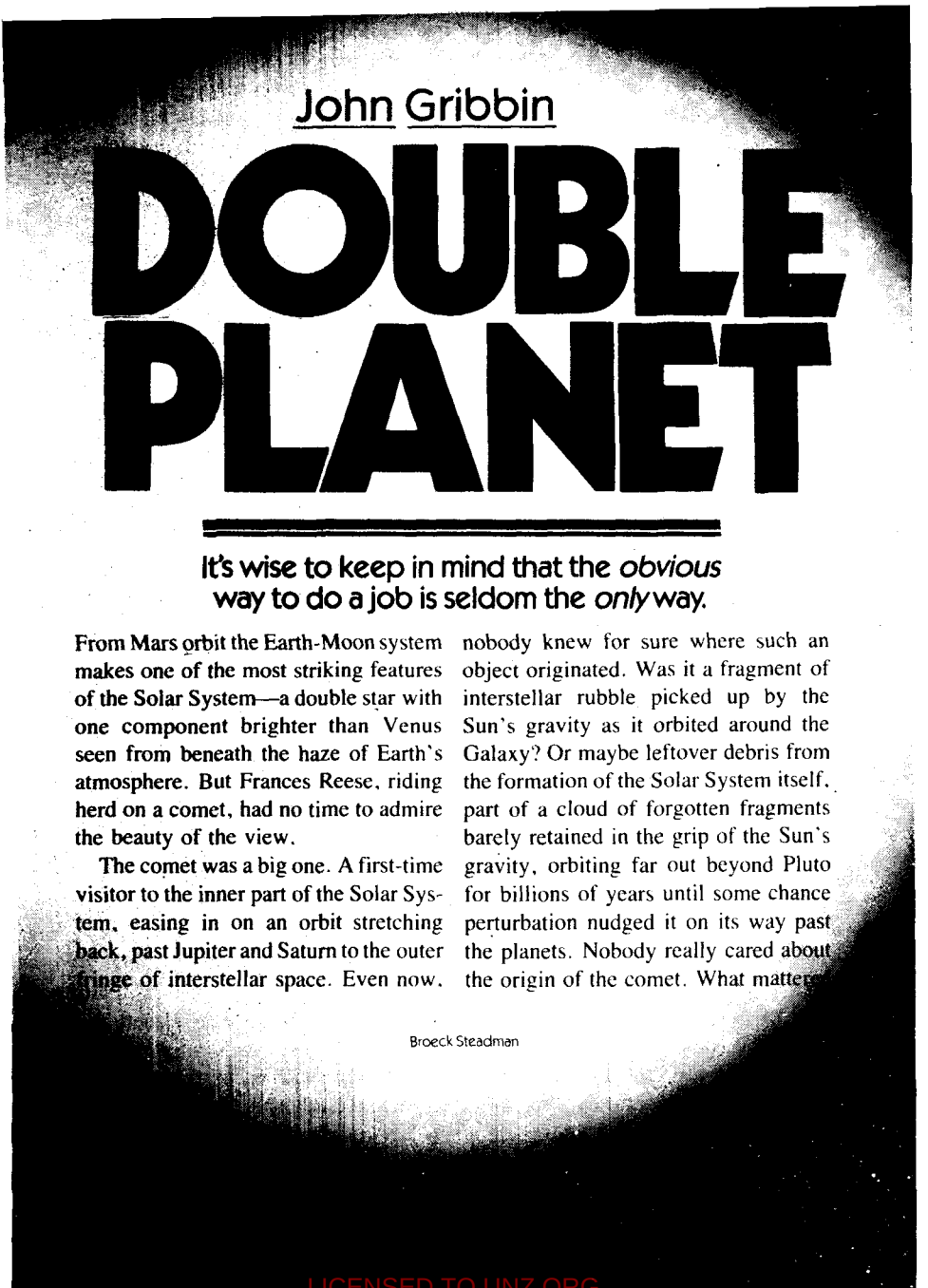
John Gribbin

DOUBLE PLANET

It's wise to keep in mind that the *obvious* way to do a job is seldom the *only* way.

From Mars orbit the Earth-Moon system makes one of the most striking features of the Solar System—a double star with one component brighter than Venus seen from beneath the haze of Earth's atmosphere. But Frances Reese, riding herd on a comet, had no time to admire the beauty of the view.

The comet was a big one. A first-time visitor to the inner part of the Solar System, easing in on an orbit stretching back, past Jupiter and Saturn to the outer fringe of interstellar space. Even now, nobody knew for sure where such an object originated. Was it a fragment of interstellar rubble picked up by the Sun's gravity as it orbited around the Galaxy? Or maybe leftover debris from the formation of the Solar System itself, part of a cloud of forgotten fragments barely retained in the grip of the Sun's gravity, orbiting far out beyond Pluto for billions of years until some chance perturbation nudged it on its way past the planets. Nobody really cared about the origin of the comet. What matter



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was the burden it carried, a million trillion tons of ice and snow, plunging on a course that would take it, thanks to the deflection caused by Jupiter's gravitational slingshot as it went past, within an astronomical hairsbreadth of that beautiful double planet.

A hundred years before, there would have been no prospect of human interference with the trajectory of such a monster. It was only in the 1980s, after all, that the first primitive probes had been able to rendezvous with a comet, on Halley's return in 1986. Reese's job still wasn't easy. With limited resources and a team hastily pulled together from other projects, she was expected to weld the great ice blocks—water ice, frozen carbon dioxide, ammonia and the rest—into some sort of coherent whole, dismantle the nuclear engines from most of the ships, and mount them to provide thrust on the cometary nucleus, using the virtually limitless supply of material from the ice itself as reaction mass. The resulting effect would be feeble compared with the gravitational forces that had set the comet on its way, but enough, by the time it crossed the orbit of the Earth, to nudge it a few hundred thousand kilometers from its present path. And since the computer projections drew that present trajectory right between the Earth and the Moon, with an uncertainty rather larger than the distance of the Earth from the Moon, a few hundred thousnd kilometers could be crucial at that time.

Even so, it hadn't been easy persuading the politicians to make the attempt.

"A comet, Doctor Kondratieff, is hardly something to strike terror into our hearts in the 21st century, you know." The Secretary to the Council had smiled tiredly at his science adviser, preparing to dismiss another impossible claim upon the world's limited resources. Why couldn't these people understand that they couldn't return to the twentieth century, and that what effort could be spared for work in space had to be geared to practical ends? After the fiasco of the O'Neill colony, anyone could see that space was a waste of effort, even though the technology to reach Jupiter certainly existed.

"But, sir, allow me to explain." Kondratieff felt the sweat on his palms and tried to keep calm. It had been hard enough to get this audience, and on what he said now rested the only chance of deflecting the newly discovered comet from its path.

"You must appreciate, sir, the difficulty of predicting the precise fate of this object. The Earth and the Moon follow a complex path around the Sun, as you can see from this diagram. Most people think the Moon circles around the Earth, but it doesn't. The Earth and the Moon are more evenly paired in size than any other two planetary objects; the Moon is as big as Mercury, it's really a planet in its own right. Because of this, it's attracted by the Sun's gravity even more strongly than it's attracted by the Earth. To the astronomers, Earth and Moon are individual planets that each follow their own orbit around the Sun, each perturbed by the other. So both the Earth and the Moon follow wobbly orbits. All we can say about the comet's orbit is that, left alone, it will intersect this double orbit just when the

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two planets are there. It may pass harmlessly by. But it could very well strike the Earth."

The presentation was faultless, Kondratieff was sure. The facts spoke for themselves, and the computer animation of the comet's orbit piercing the interwoven strands of the orbits of Earth and Moon around the Sun was the icing on the cake. The probability of disaster might seem small, but as the report spelled out the effects would be immense. A small risk of an immense disaster; the only sane course of action had to be to reduce that small risk precisely to zero, whatever it cost.

"If this comet strikes the Earth it could be the greatest disaster since the death of the dinosaurs, worse than the nuclear holocaust we so recently narrowly avoided. We know the Earth has been bombarded from space over the eons, and we are pretty sure now that these bombardments explain why there are sometimes massive extinctions of life in the geological record. Sixty-five million years ago, it wasn't just the dinosaurs that died but hundreds of other species. And the best explanation is that the Earth was struck by a giant meteorite which wreaked havoc on the environment."

"I know all this." The Secretary leaned back and waved a hand in dismissal. "I may not be a scientific expert, but I do read the popularizations. That disaster was caused by a huge lump of rock, not a snowball. And it may have been a disaster for the dinosaurs, but not so bad for us, eh, since it opened the way for the mammals."

Kondratieff, not for the first time, cursed inwardly the Secretary's habit of reading popularizations of science for light relief, and doubly cursed the writers who offered glib popularizations to a gullible readership.

"Of course, sir, I'm not suggesting a disaster on that scale. But this dirty snowball still has a mass of 10^{18} tons—that's a million, trillion tons of ice and snow. It's the biggest thing to come into the inner Solar System since civilization began." He had a flash of inspiration. "And remember what happened in 1908. The Tunguska Explosion. Trees were knocked down all over Siberia. That was caused by a fragment of comet exploding in the atmosphere. If it had arrived a few minutes later, the rotation of the Earth would have placed Leningrad directly under the explosion. That's what even a small fragment of a comet can do, and we are dealing here with one of the biggest."

Perhaps the popularizers deserve some credit after all. The Secretary certainly had heard of the Tunguska event, and his family came from Leningrad. By such silver-tongued persuasion did Science Adviser Kondratieff set the wheels in motion for the Reese expedition. If anyone except Kondratieff and Reese had known what the real purpose of the expedition was, however, it would, literally, never have gotten off the ground. After all, if you can nudge a comet *this* way as it moves through space, it is just as easy to nudge it *that* way, *toward* a collision instead of away from one.

From inside the hull of the *Sir Fred Hoyle* there would have been no way to admire the view of the Solar System's unique double planet, rapidly gaining

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in brightness ahead, even if anyone had had the time. With its engines removed, the command ship of the New Aeronautical and Space Administration's expedition just provided room for all the members of the expedition to gather and talk directly, face to face, without using radio. The seals that kept the compartment airtight were only patches, welded on after the engines had been removed, and everybody wore full suits and kept helmets at hand. The air they were breathing came from the comet itself, oxygen electrolytically cracked from water. Chemically, the atmosphere was pure; emotionally it was highly charged by speculation about the reason for this unexpected gathering, called at short notice by Commander Reese.

"I've called you here to let you in on a secret." The buzz of talk stilled at the Commander's quiet words. "You know how much this expedition has cost NASA. Four ships out of the seven we came on won't be returning to Earth orbit, and three ships hardly constitutes a spacegoing fleet. We may be saving the Earth by this gesture—Bill, I know you think there's no risk to Earth, but hear me out—even if there is a risk, and we are saving the Earth, the losses might sound a death knell for manned spaceflight.

"It's all very well arguing that by proving the value of a spacegoing ability we're opening the door for increased budgets. You know as well as I do how the political mind works, and unless there are tangible risks or real benefits immediately visible, the political mind isn't going to do anything about space exploration."

"But that's what I said all along!" Bill Noyes could no longer contain his angry astonishment. "*You're* the one who persuaded us to join this crazy scheme, with your talk about how we'd be such great popular heroes the Council would have to let us have a crack at rebuilding Lagrange One."

"And I told the truth, up to a point. Sure, they'll let us have a go, with our pathetic three ships. But they won't give us the resources for more, and we can't do the job properly without. *But it doesn't matter*. We're going to give the Earth something better than Lagrange One, something to fire the imagination of all the people disillusioned with space, and make the Council sit up and take notice."

"You're not going to drop this iceberg on top of the bloody Council, then? That's the best thing you could do for the space program."

"No. We're going to drop it on the Moon."

Reese looked around the group. Floating freely, she had hooked one foot comfortably under a convenient pipe. Relaxed, her face spread into a smile as she watched the others wrestling with what she had said.

"The Moon!"

"What on Earth for?"

"She's crazy."

The noise of argument started to rise about her again.

"Do you really want to know why?" she asked quietly. Slowly the noise died down as they all turned toward her, wondering.

"Can't you make a couple of intelligent guesses between you? Take a deep breath and think hard." She resumed her impersonation of the Cheshire Cat.

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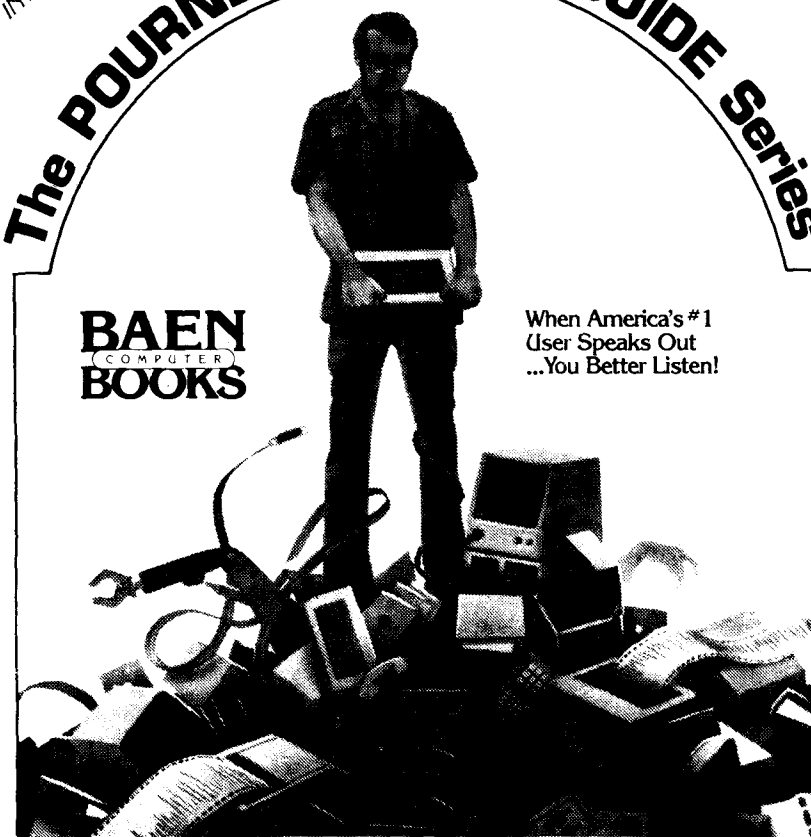

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Kristofferson saw it first. "It's the oxygen! You want to put an atmosphere on the Moon! But will it work?"

"Of course not." Noyes was checking through a calculation on his computer. "To keep an atmosphere a planet has to have an escape velocity at least six times the mean velocity of the molecules in the atmosphere. For oxygen, at about zero Celsius, the Moon couldn't keep an atmosphere for more than a few hundred years. Molecular weight's too low—only 32. Right boss?"

"Up to a point, Bill. The one-sixth rule works for keeping an atmosphere for a *very* long time—billions of years. But as long as the atmospheric molecules have a mean velocity less than about one-fifth of the escape velocity it takes hundreds of millions of years for more than half the molecules to leak away. Jeans worked it all out, back in the 1920s. Still no good for oxygen, but even at about 100 Celsius the Moon could keep a respectable atmosphere of carbon dioxide for as long as any of us are likely to be interested. The extra mass means the molecules move just that much slower at the same temperature. The trick is to get the CO_2 there in the first place, which is where we come in."

"So who wants a CO_2 atmosphere?"

"Come on, Dave, you know better than that. The Earth started out with a CO_2 atmosphere, and the odds are it got it from a comet, or several comets. Why do you think I chose this ship to lead the expedition? I knew the Council weren't bright enough to make the connection, but after all Hoyle was the guy who made that theory respectable. All the Earth's atmosphere, all the water—all the volatiles came in from space after the planet formed. The first volatiles had to come in at least one hard landing, but once *any* atmosphere formed it would act as a brake and slow down any other cometary chunks coming in from the outer Solar System. We're going to provide the Moon's hard landing. Once we've done that, we can lob any old bits of ice and snow in from the asteroid belt, and they'll stick. We can add material faster than it evaporates, and if we want oxygen to breathe we can keep it in domes or underground. We're riding 10^{18} tons of carbon dioxide and water. It won't exactly make a thick atmosphere, but its a start. Add that to soil and you've got a pretty good basis for growing plants."

"And you've got a perfect meteorite shield."

"The temperature will stabilize out."

"We're not talking about repairing a tin can in orbit; we're offering the world a second whole planet. They'll have to go for it."

"Will it really work?"

"Well, we're going to find out. The problem is, we've got to make the orbit of this iceberg nearly circular, drop it in so that it just creeps up behind the Moon in its orbit round the Sun. Jupiter's done half the job for us, we have to do the rest. You've heard the good news, but there's more. It's going to be a lot harder than just deflecting the thing out of the Earth's path."

The passage of the comet within half a million kilometers of the Earth turned the attention of six billion people upward and outward, away from their immediate problems. The return of the sole

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surviving ship of the expedition, with the five survivors from the 18 men and women under the command of the late Commander Reese was the biggest media event of the 21st century. And when the First Secretary proposed to the Council that the only fitting tribute to the lives that had been sacrificed to save humankind would be to take up afresh the challenge of the new frontier, build a fleet to take advantage of the opportunity so strangely provided, and make the Earth and Moon forever a true double planet, no voice was raised in opposition.

"It's best this way, Kondratieff, but don't think I am fooled." The Secretary turned from his balcony where the Moon, nearly full, was visible just rising above the horizon. "So we discovered that the thrust from four engines could not deflect the comet sufficiently, but six could do the job. Well enough to save the Earth, anyway, but not well enough, even with all that onboard control, to avoid the Moon. Thirteen martyrs, because those six engines had to be controlled until the last minute. I can understand that such a thing is necessary to hit accurately a moving target; not so necessary if all you want to do is miss the target. The military mind, you will appreciate, knows all about shooting at targets.

"So. You have given us the Moon, whether we like it or not. Within five years we'll have bases; in fifty we will be adding to the atmosphere so—fortuitously?—provided in that epic catastrophe. You expect me to be mad, to accuse you? To dismiss you even? Not at all. I'm not saying you weren't wise to keep me in the dark beforehand; the risk was too great. But now, there are opportunities."

"Opportunities? But, sir, you always dismissed the notion of opportunity for mankind in space."

"I dismissed the projects I was offered, Kondratieff, and with good reason. Tin cans in orbit, as far away as the Moon. What opportunity is there in a tin can? How many could Lagrange One have taken, even if it hadn't been for the accident? A few thousand, an elite, something for the masses to resent. The O'Neill colony was never more than an elitist concept, taking resources from the masses and building a plaything for the few. A whole world is different. You talk of the new frontier, and you speak better truth than you know. One sixteenth of the area of the Earth—one-fifth of the land area of our planet—is waiting there now for us to tame. It will take far longer than it took to tame the so-called new world here on Earth. But that's all to the good. The longer it takes the better, because when its done we'll only have to find another new frontier, to save ourselves from stagnation. Yes indeed, Kondratieff, you have done well."

And, thought the Secretary, if the military mind understands how to hit a moving target, so the political mind understands how to seize an opportunity when it arises.

He turned back to the balcony, Kondratieff now at his side. The Moon was clear above the horizon in the still night. Unobscured by cloud, yet faintly indistinct, seen as it had never appeared before during human history; not quite fuzzy, yet not quite sharply outlined; a sister planet in the making. ■

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Managing people is more art than science—but one of the first requisites of a good administrator is that he know people as they *are*, and not as handy labels portray them.

W. R. Thompson

FRIENDLY ENVIRONMENT

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"The environmentalists have crossed us up again," Scott Clements fumed. "Now they're coming out against the powersat project. They claim it'll upset the weather down there."

"I heard about that." Robert Dubois started setting up the checkerboard, while he tried to think of a quick, graceful way to change the subject. He didn't want to hear about the Earthside environmental movement. As Port Goddard's Director, he could find enough politics on the Moon to keep him miserable. Scott, however, couldn't help getting worked up over the idiocies perpetrated in the name of protecting Earth's environment.

The worst had come just two years ago, when the Verdant coalition had waged a successful campaign to prohibit the use of fusion power in North America. They had convinced a majority of people that fusors were dangerous, and the big generators had been taken offline. Now there were rolling blackouts in most cities, and the power shortages had caused cutbacks in industrial production and employment. Bob had watched all of that unfold on the Earthside newscasts.

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While that happened, the Orbmech consortium had hit upon a way to circumvent the fusion ban. In a variation on the old solar power satellite concept, they built a large fusor and maser at one of their orbital factories, and towed the powersat into a geostationary orbit over the Pacific Ocean. When the rectenna site in Nevada was finished the system would be able to pump fifty gigawatts into the power grid.

Bob thought it was inefficient, but that didn't matter. It could deliver power at competitive rates, which was all that interested Orbmech and its stockholders. More importantly, the project permitted the consortium to expand its space operations, which in turn meant expansion for the lunar colony. It was an ill wind which blew no good, and Bob thought that was an odd saying to bring to an airless world.

"I'll never understand the Verdants," Scott said. He sat down at the table with his back turned to the recreation room's television. "They'll eat food grown with synthetic fertilizers and pesticides, they'll buy cars made from metal we mined from the asteroids—and then they'll plunk their healthy, well-fed butts into those cars and drive to a rally against 'dehumanizing' science."

"I'm glad you don't understand them," Bob said. They started moving checkers. The spaceport chief was waxing eloquent again, Bob warned himself, which told him that this conversation would turn into an argument soon. There were other people in the rec room, talking almost loudly enough to mask the television's noise, but Bob didn't see anyone who would rescue him. He understood that; people came to a rec room to relax and socialize, not to debate current events. "I don't think I could trust anyone who understood the Verdants. Your move."

"Yah." Scott fingered a checker. "I can't believe how widespread their ideas are. Y'know, there's even an anti-powersat article in this month's *Current Science*."

"I know. I skimmed it."

"You should've read it, Boss. Nine-tenths of it is flawless, technical and mathematical poetry. It starts out with the fact that the powersat can pump fifty thousand megawatts into an area one kilometer in diameter. That can make quite a hotspot—sort of like using a magnifying glass on a sunny day."

Bob shrugged, and made a move. "That's what it's supposed to do."

"Sure enough. Well, elementary physics says that the air over that hotspot will get heated, rise and expand. It flows out from the rectenna site, and Coriolis forces spin it into a maelstrom a hundred klicks wide. It'll be permanent, too, because that fifty gigawatts is always—"

"Wrong," Bob said. "The rectenna absorbs the energy almost perfectly. There's a two percent loss into the environment, I think. Fifty gigawatts—"

"—would mean a hundred percent loss," Scott concluded. "In other words, all of the energy is thrown away as waste. That's preposterous, but what's worse is that the *Current Science* article is a popularization of a treatise in a professional journal. You know we're in trouble if scientists feel they have to play up to the environmentalists like that."

Bob hopped a pair of Scott's checkers

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and put them aside. "I wouldn't worry about it, Scott. This will all blow over once Orbmech begins deliverying power. It's basic economics—power means jobs and prosperity, which everyone wants. No power, no jobs, no money. All Orbmech has to do is to string them along a while."

"String them along," Scott muttered. "That won't wash, Boss. People tried to do that when they came out against genetic engineering. They lied themselves blue in the face about how dangerous it could be. Scientists tried to fight that by being reasonable. They agreed to double-check some things, add more safety standards, and other things like that. Then the activists started crowing that this just proved they'd been right in the first place—if bioengineering had been so safe, why tighten up the standards now? So they got it banned. You can ask Doc Helen how much *that* madness cost the human race." He jumped one of Bob's checkers, picked it up and jabbed the air with it. "Human progress is getting hamstrug by Earthbound maniacs who can't give *one sane reason* for—"

"I *know*, Scott." Bob pushed a checker, then studied his spaceport chief. Scott was off-duty, but he still wore his work coveralls. He had removed the current NASA insignia from the garment, and replaced it with the venerable blueball and canard emblem. A lot of colonists had done that, and it meant more than just nostalgia for the early days of the Space Age. Bob had heard enough from different people to know that the old NASA patch symbolized the spirit of those times, when space was opening up and nothing seemed impossible. That was precisely the sort of thing which would appeal to the average colonist. "Let's stop playing with words," Bob said. "You're going to suggest that we declare independence."

"Damn right." Scott nodded vigorously. "We both know what we could do for the human race, if nothing held us back. Hell, look at what asteroid mining has done. It's ended resource depletion on Earth, plus strip-mining and the pollution from ore-processing plants. It ended the danger of a world war over resources—and we did a lot of damage to Russia and South Africa when we forced them out of the world market."

Bob sighed. With all the equipment shortages we have, he thought glumly, some fool had to go and ship us an extra supply of soap boxes for our orators. "Scott, you're preaching to the choir. I just can't see any reason that would justify independence." He smiled puckishly. "You're not plotting a coup, are you?"

"Of course not! But I'm not the only one who's hot on independence."

Bob nodded in agreement as he captured a checker. "Offhand, I can name a half-dozen of your fellow firebrands."

"Firebrands?" Scott looked surprised. "I'm not a politician, Boss. None of us are." He leaned forward over the checkerboard and spoke eagerly. "But I'll tell you something. A lot of people are interested in setting up a Lunar Republic, and it ain't because we're a lot of radicals.

"Listen. We keep talking about the potentials of space, and how much good we've already done. Well, we've only

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fulfilled a tiny part of our potential, and we've only benefitted a select chunk of Earth. Places like India and the Saharan nations don't get much from us. Too much of what we do up here goes for making better cars and flashier games. *We* want to do things and go places. *Why should we be limited when there aren't any more limits?*"

"Because we can't get away with independence," Bob said wearily. The political naiveté of the "average" colonist—who had a college education and was a genius—annoyed Bob. Everything looked perfectly straightforward to them, it seemed. "Don't you think I haven't thought about it, too? I get so sick of dealing with those—skip it. Let's suppose that we all put on dirty fatigues, grow week-old beards, and declare the revolution. What happens next? The Aerospace Force intervenes, that's what."

Scott lowered his eyebrows. "We could prevent that. The trick would be to convince Washington not to order them in." He glanced at the board and advanced a checker.

"That's some trick," Bob said, taking the checker. "A revolution would mean seizing the orbital factories and a lot of spacecraft, correct? That would mean pauperizing Orbmech, for openers—"

"We plan on compensating them," Scott said. "We couldn't survive without those things, much less get anything done. Why create a new nation if it's going to be dirt-scrabble poor?"

"It's still theft." Scott hopped some of his checkers, and Bob made a countermove. "More to the point, it could disrupt the American economy. Things are bad enough down there as is. The government can't tolerate more trouble. It'd fight."

"We could work things out," Scott insisted. "Dealing with us could be easier and cheaper than dealing with Orbmech. Everyone would just have to stay *reasonable about things.*"

"Reasonable? Hoo boy." Bob's grin was lopsided. "Could you tell me about the Verdants? I may have missed something—or do you think they're reasonable?"

"Hell, they're just one pressure group, not the whole nation. I know we can work things out." In quick succession, he hopped all of Bob's remaining checkers. "Besides, we may have to, whether you like it or not. I've taken a little survey, and I'd say that two-thirds of the people in space would support autonomy. They'd rebel for something better, something more than being cogs in an empty economic machine—" He stopped himself, then went on, "The point is that a revolution may be inevitable. An idea with this much popular support won't go away. The way things stand now, almost anything could light if off."

Bob started loading the checkers back into their carton. "That could still be a disaster, Scott. Too much can go wrong. A revolution couldn't avoid disrupting the economy, even if all you did was to stop trade with Earthside while you rearranged things. How many people would die in that time without the interferon and alpha-antiviral we ship down to them?

"Besides, my prime duty is to look after Port Goddard. I think you're doing something that will endanger the col-

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ony. I *can't* cooperate with that." A flicker on the rec room's TV screen caught his eye: the opening of a newscast, beamed up from Earth. "Can we put this on hold? I'd like to catch the news."

Scott nodded, and turned his chair around while Bob leaned back to watch. Most of the news was pap, Bob noted: flashy, but trivial, pointless. The networks didn't seem to have their hearts in reporting the news any more. There were shots of a festival in Maine, followed by the disastrous premiere of a new symphony, a high-society scandal in Singapore, plenty of commercials . . . Bob noted with interest that Scott looked bored. If he got bored enough, Bob hoped, he might walk out and forget about their argument for a while. At least that would make a small victory for Bob.

There was a shot of Mexican nationals being deported from Arizona. In pedestrian tones, the network anchor said that they had fled Mexico in the aftermath of the latest major hurricane to hit that country. The storm had destroyed crops and flooded a large part of the countryside. The anchor added that a second hurricane would hit Mexico in a few days, and that would add to the immigration burden. She sounded thoroughly uninterested.

"That's the delicate climate we're not supposed to risk unbalancing," Scott said in a stage whisper.

Bob shushed him. The scene changed to the floor of the Senate, and the anchor's voice stated that the Mexican situation had been debated at length. Bob ignored the rude noise somebody made at that, but he noticed that most of the people in the rec room had their attention on the screen. Bob recognized the image of Senator Paravelli, an experienced politician and one of his party's leading candidates for the presidency.

"This situation is critical." The set's speaker turned his voice harsh. "Our borders have been overrun by these hordes. They're taking jobs which should go to honest, unemployed Americans, and they're swamping our welfare rolls. If the Mexican government won't stop this unofficial invasion, we must. This is a purely foreign problem, and if Mexico can't keep its house in order, they shouldn't be allowed to fob off their problems onto the generosity of the American taxpayer!"

The thunderous applause which followed the speech disturbed Bob as much as the speech itself. How could anyone approve of that? he wondered. But the camera panned across the Senate floor, and only a few Senators—Neuthal was the only one Bob recognized—seemed displeased.

Then Bob saw the foul look on Scott's face. "Don't say anything," Bob grated. "Don't say one damned thing." Bob got up and left.

"Bob, wake up!" Helen Esterhazy pounded on his door, then pushed it open. The doctor rushed into Bob's quarters, smiling broadly. "I've got the answer! I know what to do about Hacker now!"

"Hacker?" Bob sat up on the edge of his bed and tried to clear the fuzz from his mind. Hacker—he was that psychologist, the one who had been making such a nuisance of himself over the past few days . . . no, there was

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more to it than that. Bob recalled that he was a big name on Earth, an influential man, that was it . . . and he didn't like the colony or the colonists. He was going to endanger the colony, try to close it down—and humanity's future with it—for reasons which amounted to little more than stoking his ego and catering to the public's anti-science whims. Hacker had done similar things before, with great success.

Helen had a plan to stop his attack. She was going to use a crude form of brainwashing to push Hacker into a severe nervous breakdown. Even if he recovered, his power and prestige would have vanished with his sanity, and that would render him harmless. That plan had horrified Bob, but not as much as the alternative of letting the man have his way. Bob had given Helen his approval.

"Yes, Hacker." She nodded happily. "I won't have to drive him crazy after all. There's no need to destroy him—I've got a much better idea now."

"What is it?" Bob asked quickly.

"It's so obvious! I can't imagine why I didn't think of it before."

"Tell me!"

"Can't you see it?" she smiled. "All I have to do is to . . ." Her mouth kept working while her voice faded into an electric buzz.

Bob woke up and swore viciously.

After five years, he had never managed to think of another way to stop Hacker. On an intellectual level, Bob knew that there had been no choice but to stop him. Too much had been at stake; humanity's survival depended on the development of space. Bob could see that, but Hacker couldn't even consider it.

Bob's conscience wasn't open to reason. He still had to wonder if there had been some more humane choice . . . or if Hacker had been the menace he seemed. The logic of the situation may have been vacuum-tight, but that didn't help his conscience. It still gave him nightmares.

The buzzing came from his room's air vent. Probably a dust precipitator had just gone bad, he told himself. Conceding that he wouldn't be able to get back to sleep, he got up, dressed, and left his quarters.

It was four in the morning by his watch, and the colony's environment was in its night phase. The overhead panels in the corridors glowed a feeble red, and the air was cooler and moister than it would have been by day. It *felt* like nighttime; the effect was subtle and soothing.

Bob took a closer look at one of the panels. A faint silver glow in one corner told him that the biolights were on. They activated themselves for a week or so every month, in sync with the phases of the Earth, to prevent biorhythm upsets. Some people were susceptible to them, and could grow critically ill from them.

Bob was one of those people, and he regarded the biolight with ambivalence. It galled him to know that his physical and mental health could be impaired by something as primeval and basic as biorhythms. There was something unesthetic about that—but it was a fact of life for him. He couldn't survive off the face of the Earth without the lights. They were an effective way of over-

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coming a natural limitation, and as an engineer he could appreciate that. In a way they were on a par with the power sat, he mused: they were a practical answer to a problem. They did the job.

"Ah, there you are," Helen Esterhazy said from behind him. "Wait up, Bob. Are you going anywhere in particular?"

"No, I'm just stretching my legs." Bob stopped, then peered up and down the darkened corridor. They were alone. "I've got some good news. You'll have those purified nucleic acids in another week."

The doctor grinned happily. "That's great! How did you swing it? Or shouldn't I ask?"

Bob permitted himself to look pleased. He had little trouble obtaining the supplies and equipment which Helen's work required, but it took a skilled and devious bureaucrat to hide the inevitable irregularities which arose. "The Doving group is going to investigate the use of nucleic acids in semiconducting colloids," he said. "It's legitimate research, by the way. Upjohn has already reactived its facility for making the stuff on the MOF station, and the Dovings have ordered it in kilo batches. Plenty of it will be wasted in experimentation, if you know what I mean."

Helen appeared satisfied. "Just get it to us fast. We're stuck without it."

Bob nodded, and wondered if anyone on Earth suspected that bioengineering research was still being conducted on the Moon. Probably not, he thought. He had done his best not to leave any evidence of the crime in paper records or computer files. Helen and her *ad hoc* group of researchers showed even more caution. Despite the natural scientific urge to discuss research freely, they kept quiet. Loose talk would do worse things than get them into legal trouble. It would end their research forever.

"Playing God," the Verdants had called genetic engineering. They said that that the human race didn't have the wisdom to tamper with its genes; only God should change that which God had created. Bob knew that Helen didn't give a damn about that sort of theology. Genetic engineering could give her new tools to fight disease. For that she would gladly court hubris and its dangers.

There was a real danger in it for her. There would be an investigation if anyone exposed the clandestine research. The exact legal details were shadowy, but Bob knew that an investigatory committee could take Helen back to Earth. That would kill her. The doctor's cardiovascular system had irreversibly adapted to lunar gravity, and could no longer tolerate anything stronger than that.

That didn't seem to trouble her. Helen's only concern was to keep the project running—especially now, when it had created treatments for a few specific diseases. Helen's only emotions on the subject struck Bob as being impatience and faith—impatience with delays and secrecy; faith that she could find a way to get her discoveries to a world which seemed to abhor them. At times that looked hopeless to Bob.

"I'm sorry I can't get it to you any faster," Bob said. "But you know how it is. Anyway, what brings you out this late, Doctor? Trolling for patients?"

"As a matter of fact, yes." Her slight smile vanished. "I didn't mean to talk

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smuggling now. The truth is, I received a call a while ago. Somebody saw you walking around, and he told me you looked like the devil."

"What a flattering comparison." His tone had gone sour. "Is this going to be personal or professional?"

"Should there be a difference?" She lowered her voice. "Don't try to fool me, Bob. You've been having your nightmares again. Come on, we can have some privacy in my office." She tugged on his arm.

"I've been thinking about your problem," she said, once her office door had closed behind them. She pulled out her chair and sat behind her desk. "Tell me, why should you have nightmares about Hacker?"

"Why?" he repeated blankly, sitting on the edge of her desk. "What we did to him would give anyone nightmares."

Helen shook her head. "Not me. Let me rephrase myself. Why should you have nightmares at one time and not another? Your episodes of night-terror come in definite cycles. That suggests that something provokes them. Now, has anything happened lately to upset you?"

Bob sighed. "I had another run-in with Scott over independence. You know, for somebody who claims to be apolitical he's pushing awfully hard."

"That isn't it. Our rebels have been making noises for months now." She gave Bob a look which made him feel that he was being scanned by one of her medical instruments. "I'll make a bet with you, Bob. You've been watching the news again."

"It's no bet," he told her. "But what makes you mention that?"

"I had a stroke of genius this evening—or maybe the well-known Dubois intuition has rubbed off on me." She gestured at her office's computer terminal. "I checked your medical file against the computer's alamanac. It develops that the last time you had a string of nightmares was during the Kerala plague. Before that it was during the Chaco War, and before *that* it was the Somali famine, and the Iran earthquake. Now it's Mexico. Conversely, when the news is quiet so is your sleep."

Bob mulled that over. The dates looked right. "The question is, why should Earthside disasters give me nightmares about Hacker? What's the link?"

Helen shook her head. "I couldn't say yet, so let's try another approach. Why should Earthside disasters bother you?"

The question left him perplexed. "Why shouldn't they?"

She snapped her fingers. "I *knew* you would say that. It's a perfectly normal response from a decent human being." Helen rested her elbows on her desk. "Tell me about this Mexican situation. Anything at all."

"Well . . . there was that Senator Paravelli on the news. He talked as though the storm and everything was Mexico's fault, and that the United States shouldn't do anything to help them. The richest, most powerful nation on Earth . . ." His voice trailed off helplessly.

Helen leaned back in her chair and wove her fingers together. "I think that's a big part of your problem, Bob. You've got an attitude that's almost universal in space—it's as normal for us

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as fear of falling is on Earth. Life here is dangerous, and it requires a lot of intelligent, cooperative effort to stay alive in this environment. Survival means looking out for one another, constantly—check your buddy's air, keep an eye open for snafus, call in a doctor when somebody needs help, and so on. It means placing the same high value on all human lives, because we all depend on one another. We can't afford anything less.

"The trouble is," she continued, "That sort of hyperdeveloped concern tears your heart out when you can't do anything about a situation—and there's not a thing any of us can do to influence Earthside events. That's bad enough for most of us—I guess it's fueling some of the independence movement—but it's especially hard on you. You're the top authority on this world, Bob; you're the man who gets things done, but your power does not extend to your fellow humans on Earth. It's a hell of a trap."

"I think I see . . . but what makes me dredge up Hacker? Does he symbolize my conscience, or what?"

The doctor considered that. "Bob, I don't have the answer for that. You'll have to find it; it's in you somewhere. It could be that he's a symbol of exactly what he was to you—an enemy of humanity."

"That could be. I just don't know." Bob hesitated. There was something he had never asked her before. "Helen, you did the actual dirty work to Hacker. How do *you* manage to live with what we did?"

"How? Very easily. I firmly believe that Hacker, had we let him attack the colony as he planned, would have created a catastrophe for us and for Earth. Earth is on the edge in many ways, and this colony may be one of the few things that keeps it from going over. We couldn't afford to gamble.

"I don't know what sort of chaos Hacker would have brought us. All I know is that I'm a doctor, and I can't practice my trade without a lot of specialized pharmaceuticals and instruments. I wouldn't have them in a Dark Age, but I *would* have patients with diseases I've only seen in textbooks. Bubonic plague, polio, yaws, scurvy, cholera—no, Bob, I didn't have any trouble playing Lady Macbeth to your Thane of Cawdor." There was a cold and distant look in her eyes. "Sometimes it bothers me because it doesn't bother me."

"I see." He found himself perturbed by her allusion to Shakespeare's bloody Scots king. "I wish I had your sort of faith in things."

The doctor patted his arm. "Don't fret. I'm certain that you're close to working this thing out. Just don't give yourself ulcers again."

The lights were brightening with artificial dawn as Bob entered his office. It was too early to begin his work, but he had other things to occupy the time. As he sat down at his desk, he opened the bottom drawer and pulled out a thick packet of literature.

In the past month he had begun to make a study of the Verdants. He had persuaded some of the pilots who regularly commuted between Earth and the colony to collect some environmentalist literature for him.

Much of it reinforced the media im-

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age of the Verdants. The leaflets and pamphlets were confused and virulent, and their shabby intellectual content seemed to be reflected in cheap printing and atrocious grammar. Bob expected that. Some of the material, however, didn't fit that pattern at all.

Bob felt that he knew enough about the Verdant coalition to estimate the scope of his igorance. There was no such thing as *a* Verdant, it now appeared; the media simply lumped the environmentalists together under one convenient tag. Coverage seemed to concentrate on the more flamboyant parts of the movement: the saboteurs, radical demonstrators, back-to-nature extremists, and propagandists such as Hacker. They were the ones easily covered in a thirty-second or one-minute news spot—which made them the most visible part of the movement.

That was unfortunate, Bob thought. The permanent colonists got the bulk of their information about Earthside events over the television. That distorted their perspective. There weren't many reliable figures available, but the ones that Bob had told him the media image was badly in error. It was much like saying that everyone on the political left was a communist, or everyone on the right was a fascist. In truth the extremists were a tiny minority, and as a rule they were disliked by those closer to the center.

Bob extracted a small paperback book from his collection. The book was much more typical, he thought. *Striking the Balance* was a restrained, well-reasoned book, written by a woman who described herself as a Kansas housewife. She didn't persuade Bob that science and technology had gotten out of hand, but then he wasn't reading her book to be converted. He wanted an understanding of her viewpoint, and he felt he was getting it.

She had no interest in the long-term benefits of research, or in bigger and better ways of doing things, or in the obscure ways in which scientific development improved the world economy. The woman only wanted to know that her children wouldn't find themselves poisoned by exotic chemicals and radiations, or be left permanently unemployed by robotics and mechanization. She was interested in security and stability. She couldn't afford to worry about the future when the immediate present seemed hazardous enough . . . especially thanks to science.

Bob glanced at the book's flyleaf. If the figures there were correct, this book had gone through several printings in the past year, and sold over two million copies. Given the percentage of functional illiterates in modern American society, that was a very impressive figure, almost astronomical. This woman, without even hinting at extremism, had struck a responsive chord in a large number of people.

Yet she had missed the mark, Bob thought; there was no permanent security in the universe. Science was a valuable tool, not to be forsaken, and only it could give the knowledge which could bring a measure of safety.

All the same, it was impossible to dislike the sort of person who could write this book; from her limited viewpoint, everything she said was admirably logical. Bob wished that he could have the chance to argue with her

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. . . but that would be pointless, he thought. He couldn't sit down for a friendly chat with millions of folks like her.

His intercom beeped. "Dubois listening," he answered.

"Bob, Helen. I can't talk long. I'm leaving for one of the outposts in a few minutes—there's an accident victim who can't be moved." She hesitated. "You're still positive that independence is a bad idea?"

"Yes. I may not be able to convince anyone, but—"

"Never mind that. If I know anything, I know enough to trust your intuition. Somebody was just here at the clinic with a petition."

"Oh, really? Was it John Hancock or Thomas Jefferson?"

"Huh? Oh, no, it was nothing like that. This petition just calls for the formation of an advisory council to assist the Director. That's you. It sounded innocuous enough, but the gal with the petition said that quote-we-unquote expect you to reject it out of hand, and that this same 'we' would take things from there. That doesn't sound good, Bob."

"No, but it's to be expected. Thanks for the warning, Helen."

"Sure. I have to run now." The intercom clicked off.

Bob sat rubbing his chin. Now that he thought of it, Scott had kept using the plural form last night. That implied an organization of some sort, something beyond the parlor revolutionary stage, which Bob told himself was an overly obvious deduction. He didn't doubt that Paravelli's speech had given them enough cause to set things in motion. Paravelli's statement had almost seemed designed to enrage the average colonist.

Bob grinned wolfishly. If he was expected to reject the petition, then he'd accept the damned thing. That would drain the charge from their batteries, he thought, and it would buy him some time.

The woman whom Helen had met probably was a hothead, Bob thought. He knew the rebels well enough to know that they had as many factions as—well, as the Verdants, if only on a smaller scale. At least he could comprehend them without any trouble. He should be able to arrange something to placate them.

Maybe it doesn't matter, he thought. Just about everyone down on Earth seemed to think that space and science and technology were a menace, or at best irrelevant to humanity's needs. They might not even notice if the colonists broke away from them. They might even be glad if they went away and left them alone.

Annoyed by the sudden tightening in his belly, Bob closed his eyes and forced himself to relax. After the discomfort had passed he put away the Verdant book and went to work.

Port Goddard's central computer had streamlined the colony's bureaucratic structure, for which he was grateful. Memos couldn't get lost in transit or be misfiled somewhere. All of the colony's records could be stored in a unit the size of a shoebox . . . and best of all, as far as Bob was concerned, his desk never got lost in a paper snowdrift.

He found that he had no trouble losing himself in the grind of reports, communiqués and memos. Eventually he

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worked his way down to a note from a planetary-science lab, one which specialized in atmosphereic studies. The message was a typical proposal for an experiment, the subject being the effects of a fifty-gigawatt maserbeam on Earth's atmosphere. There seems to be a lot of this going around, Bob thought dourly, but at least this wouldn't be a bit of idiocy designed to prove the assumption that the maser was a menace. Bob switched on his intercom and connected himself with the lab's office.

"Doctor Iizuka?" he said, stumbling over the name at the bottom of his keyboard screen. "This is Director Dubois. I have your experiment proposal in front of me."

"The one concerning the powersat? Excellent." Iizuka's formal Japanese cadences were overlaid with the broader tones which all of the colonists seemed to acquire. "I am informed that the powersat is operational, but not yet in service. Would it be possible to obtain it for some tests?"

"Sure, why not? We've used it for a few other things in the past month. What do you have in mind?"

"Weather modification tests," Iizuka said. "There is ample reason to think that the maser can be used to influence the weather. Have you read any of the literature regarding the effects of the beam upon the atmosphere?"

"I saw an article in *Current Science*," Bob said.

"Indeed." Iizuka sounded disappointed, but he continued speaking, "That is a laundered version of a paper in the current issue of the *Journal of Atmospheric Sciences* . . . but it will have given you an adequate grasp of the topic."

"Maybe it did, Doctor. Could you describe the sort of tests which you have in mind?" Bob found himself slipping into an imitation of the man's formal tone.

"A test with immediate and practical results. You are aware, perhaps, of the hurricane that is now approaching the coast of Mexico?"

Bob's stomach twinged sharply. Oh, shut up, he commanded it silently. At least try to develop some subtlety. "What can you do about it? Isn't there a lot more energy wrapped up in a hurricane than the maser beam can carry?

"Yes, but that is not relevant. The important point is that the, ah, hotspot created by the maser would generate a Coriolis storm. By properly positioning the hotspot in relation to the hurricane's predicted path, we can use the Coriolis winds to change the hurricane's path. One could look upon it as a simple matter of adding vectors."

Bob grunted. "Can you imagine what the environmentalists would say about that?"

Iizuka sounded puzzled. "There is nothing to upset them, Mr. Director. The weather on Earth is not, ah, set in concrete. Climate is not a permanent condition. As proof, please consider that over the past decade *no* hurricanes in the northeast Pacific have moved ashore into Central or Northern America. Such changes are a part of nature, alas."

Bob gazed at the intercom grille. "And you can fix that, Doctor?"

"Absolutely." Bob imagined that he was nodding emphatically. "The maser

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delivers fifty gigawatts of energy. Salt water absorbs microwaves most efficiently, so the major portion of this energy will appear as heat within one meter of the ocean's surface. This energy density can raise the water temperature by fifty degrees Celsius in one hour. The figures are only slightly different for land."

Bob whistled in awe. He knew, in a vague way, that variations in the ocean's surface temperature could influence the weather. The Gulf Stream was supposed to be a major factor in making the northern hemisphere's weather, and it wasn't all that much warmer than the Atlantic. The maser, now, could make a good-sized area hot enough to boil in two hours. "You're certain that you can move a storm?"

"Yes. Theoretically it is a simple operation. The concepts and equations in the *Journal* cover it most clearly." Bob heard papers rustling over the intercom. "Given access to the powersat, it could be done at this moment. All of the calculations are in readiness."

Bob sensed the urgency in the man's voice. He could understand it. This would be of more than academic interest to him or to anyone. It was the chance of a lifetime to do something important for the world. . . . "I'll have to call you back, Doctor," he said. "It'll take a while to arrange things."

After the connection was broken, Bob shut his eyes and thought. He knew there couldn't be any question about doing this. The only problem lay in arranging for the use of the powersat—and, afterwards, in facing the aftermath. Most probably this maneuver would end his career. The Verdants would never forgive anyone reckless enough to tamper with the weather, and he doubted that anyone had an interest in saving the hide of a mid-level bureaucrat.

Bob wondered if he was doing the right thing. Even if this was the proper course of action, the Verdants would be justified in attacking him for taking this gamble. Something like this should be carefully checked out and scrutinized for hidden dangers. There were well-established procedures for such things, and as an engineer he had always understood the need for them. Yet here he was, flaunting both common sense and established procedures.

Confidence, he told himself. Confidence! If this thing worked, it would prevent untold death and suffering in Mexico. Going through proper channels would kill any chance of experimenting with weather modification; even cloud seeding had been outlawed in the United States. Besides, he asked himself, where would the world be if nobody ever took risks?

He realized that he was delaying action because this would bring an end to his career . . . but he discovered that he could accept that. Helen took a much greater risk, every day, with her covert genetics experiments. Even if he didn't have her example to live up to, he had to think of the people living in the storm's path. Not taking the opportunity to help them would be intolerable.

Bob contacted the communications department, and got a laser link with the powersat's maintainence crew. "What's your status?" he asked, as soon as the contact stabilized.

"We're fully operational." The astronaut's voice sounded bored and al-

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most resentful. "We've been fully operational for two months. We were beginnin' to think that the rest of the Galaxy had written us off, or somethin'."

"Not by a long shot," Bob said. "How fast can you start pumping watts?"

"Oh, two hours. We've got enough deuterium-tritium mix for . . . lemme see . . . ten hours peak operations. What's up? Nobody tells us anything anymore. Is this another fool test?"

"No. You're going to be participating in a weather modification test. You'll be irradiating a patch of the ocean. When you're set to operate, I'll put you in touch with a Dr. Iizuka. He'll give you detailed instructions."

"Sounds good."

"Right." Bob tried to keep his voice casual. "Listen. Keep this under your headset. Our nervous nellies down Earthside don't know about this yet, and it'd be for the best if the situation stayed that way. You know how the Verdants are—NASA hasn't told them yet, and neither should we."

"I copy," the astronaut said easily. It was clear that he liked the idea of pulling a fast one on the Verdants—as Bob had expected he would. "Well, we'd better power up the system. Out."

Bob couldn't contact Iizuka right away. To protect the man, he would have to lie to him, and the lie would consist of letting him think that Bob had spent a reasonable amount of time arguing with Earth. Bob hated deceiving his own people, but he saw no other choice. There would be an investigation afterwards, and it might end up as a judicial lynching. When put under oath, Both wanted his subordinates to be able to swear that they had been told everything was in order. Loyalty has to flow both ways, he thought.

He spent the next two hours doing some glum, practical work: making the preparations for somebody else to take over the post he'd held for a decade. He knew that he should have done this long ago; there had always been the chance that something would happen to him . . . but it would have been a tacit admission that he couldn't hold this office for eternity. God, he thought, he was going to miss riding herd on the assorted rover boys, mavericks and iron-willed visionaries who populated Port Goddard.

At length he called Iizuka again. "Everything is set, Doctor. You may begin whenever you're ready."

"Excellent. You encountered no difficulties?"

"Nothing—insurmountable. It turns out that there aren't any laws or regulations covering this sort of thing, so nobody has jurisdiction—or any objection that can stick." Of course, he reflected, the Justice Department might not see things that way, but in a technical sense it was the truth.

"Excellent. Indeed. We shall have our results within a few hours, sir. It shall be intriguing to see how closely theory and reality match."

"I'll say." There was something odd in Iizuka's voice. . . . "Is anything about this bothering you, Doctor?"

"Not directly. I wish there had been more time to, ah, fine-tune the calculations, but precision is not demanded in this task. However—you did mention the *Current Science* article. Perhaps you noticed a fallacy in it?"

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"I think so. They assumed that the rectenna wouldn't absorb any energy."

"Yes, precisely that. The *Journal* presumes that the rectenna will lose only two percent of the maser energy, which is the correct figure. The popularized version has also been, in a word, sensationalized. The original authors must feel quite chagrined."

"Yes." Bob chewed his lower lip for a moment. "Say—that two percent comes out as a full gigawatt. Can that change the weather?"

"The *Journal* treatise does not say so. I had not noticed that omission before, but the treatise concerns itself only with atmospheric dynamics under limited conditions."

The Verdants might be right, Bob thought. That didn't sit well with him, but he couldn't deny it. They might be absolutely correct on this one thing. "Can you make a guesstimate?"

"Urr—not without more information than I have. . . . Ah. I do recall that the rectenna site is located in a mountainous section of desert. Such terrain should disrupt air flow most effectively."

"Maybe that's why Orbmech put it there," Bob mused. He still felt unsettled. "Can you check this out later on?" At the moment he couldn't do anything about it, even if there was a problem. Later, of course—

"By all means." Bob wished that he could share the serenity he sensed in Iizuka's voice. There seemed to be no urgency in him. "But I do not believe that it wll prove serious. The *Current Science* article is unduly alarmist. I am at a loss to understand what motivated that."

"Well, don't sweat it," Bob advised. He tapped buttons on the intercom, and ordered Communications to put the scientist in touch with the powersat crew—by laser link, and he hoped that nobody would wonder why he had specified that interception-proof means of contact.

What had motivated them? Bob didn't want to laugh. *Current Science*'s readers by definition had a positive outlook about science and technology, and the magazine's editors gave them what they wanted. This had to mean that the anti-science malaise had infected people who ought to know better. Even they were losing faith, like cultists deserting their false gods.

According to Bob's standards that was madness. Earth had a thick, breathable atmosphere, no radiation worth noting, plenty of water and growing greenery. That seeming gentleness made complacency inviting. It was easy to be lulled by such things, to forget how dangerous and unpredictable the universe could be. The consequences of a fatal blunder—resource depletion, overpopulation, exhausting farmland soils—might not manifest themselves for a long time, but obscuring the link between cause and effect could not remove the link. The Moon has done us a favor there, Bob thought. It forces us to stay alert and think everything through. It never lulls us.

Maybe they deserve whatever they inflict on themselves down there, Bob thought wearily. Nobody ever forced Earthsiders to substitute wishful thinking for logic and foresight, and Bob saw no way to force a change. The situation looked hopeless. It might be for the best

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to concentrate on preserving the colony, and to forget about Earth—

Bob was taken aback by a sudden, intense wave of self-disgust. There was nothing special about the colonists, he told himself. With the exception of a hundred or so children, all of them under the age of eight, there was no such thing as a native colonist. Everybody had been born on Earth, had been raised there, and had acquired his basic values down there. Living in space might have emphasized some of those values and weakened others, but all of them could trace their roots back to the dawn of human civilization. Resignation from the human race was out of the question, in any form.

According to the polls, a majority of the people down there sympathized with the Verdants to some degree. Bob didn't recall the precise figures, but he reasoned that it didn't matter if they stood at the ninety-nine-percent-plus level. There had to be people down there who were worth fighting for, who didn't deserve to be dragged down into the developing chaos.

Bob shifted uncomfortably in his seat. Introspection always made him uneasy; he never knew what unpleasant things he might uncover in himself. The idea that there were some people worth fighting for implied that some people *automatically were not worth his effort.* That was a nasty thought indeed. Better to assume that all people were worth fighting for, even the hard-core Verdants and Senators such as—

Something clicked in his head as ideas began to fit together. There might be a way out of this predicament, if he truly was the adroit politician he believed himself to be, and if he had a little luck—no, he wouldn't invoke that concept. "Luck" was a sloppy label for random factors, and Bob aways did his utmost to minimize them.

The plan didn't take shape so much as it revealed itself to him, exposing a variety of facets. It would require him to let a lot of people in on the secret of Helen's genetics research. Earthside people. That was tantamount to revealing it to the more fanatical Verdants, but they wouldn't matter if everything went properly. For once they would find themselves outmaneuvered.

Any number of groups could benefit from genetic engineering, Bob thought, and from weather control. That was old data. Farmers, ethnic groups, ranchers, insurance companies, even environmentalists—the list might not be endless, but it included people with political and economic clout. It only required being explicit about things in a dollar-and-cents way.

This is something "everybody knows," Bob thought, but nobody has ever tried to use it as political coin. We've been so busy extolling the wide-ranging, blue-sky benefits of space that we've never been adequately specific about the right things.

For that matter, he continued, even such things as asteroid mining and space industry have been badly handled. People couldn't relate themselves to Orbmech's standing on Wall Street, or the cost savings of lighter, stronger materials. They needed to see immediate things, things they could grasp at once and understand. Damn it, we've been so busy moaning about their preoccupation with the short-term that we've

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never considered using it to our advantage.

He saw that he would have to strike a deal with somebody in authority on Earth. Bob himself had no power down there; the painful truth was that he was just a bureaucrat, even if most people were too polite to call him that. However, he knew people with power; that went with his job.

Joyce Neuthal struck him as the obvious choice to contact. She was a member of the Sciences and Astronautics Subcommittee. Bob had only spoken with her twice, briefly, but the Senator's acumen impressed him. She was ambitious as well: a presidential contender who had done well in the last primaries. She would get peak efficiency from any help that might put her in the White House . . . and, Bob remembered, there had been that look on her face during Paravelli's speech. That settled it.

Bob started grinning. If he did everything right, this would also pull the plug on the independence movement. If they just refrained from doing anything rash in the next few hours. . . . First, however, he would have to discuss the details of this with Helen. He reached for the intercom panel—

He froze in dismay. Helen was in a crowded, moving rolligon, heading toward an injured patient. There was no way to have a private, secure talk with her—and he couldn't order her to return. Helen wouldn't abandon a patient. If Bob tried to drag her back he would need a doctor himself.

But he had to talk with her. Ending the secrecy on the genetics research would endanger her life—and beyond that, Helen was a valuable scientist and doctor . . . and one of his best friends.

Yet this opportunity, like a launch window, wouldn't last long. If he was going to do anything, it would have to be before the Verdants could respond to his use of the powersat. He had to contact people, set things in motion, create a momentum that couldn't be countered. Seize the moment, he thought, that was the phrase. In politics as in orbital dynamics, events waited for no one.

That was the choice. It had been suspiciously easy to write off his own career, Bob thought, but this was another matter. He couldn't merely ask himself what Helen might or might not do if she were present. That would just be a way of evading his own responsibility.

Neuthal might easily decide to use this to make immediate political capital. That was the problem, Bob realized; he might not know enough about Neuthal. Human affairs were only clear in retrospect, if that, and the only obvious heroes and villains could be found in melodramas. Even the radical Verdants weren't evil; if they courted worldwide disaster, it was through ignorance, not malice. He simply had no way of knowing what Neuthal might do. This leap would have to be made on faith.

If I'm wrong, Bob thought, even if I'm right, this act could cost me my best friend. He called the communications department, and had them set up a laser link with Earth. By now they had to know something was afoot, and Bob could imagine all sorts of rumors making the rounds in a while. Laser links normally were used only when solar static jammed radio transmissions—or

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when somebody insisted on absolute privacy.

Bob got the link with Earth in a minute, but reaching Neuthal herself took over an hour. He spent the time bulling his way up a hierarchy of administrators, adjutants, aides and secretaries. All of them were less than helpful. Bureaucratic tradition and protocol, Bob reminded himself, demanded that secretaries place and accept calls for their chiefs. Doing it himself must have been bad form.

He heard a melodic chime, followed by a firm voice. "This is Senator Neuthal."

"Senator, this is Bob Dubois, Port Goddard's director. Is your line private?"

"I believe so." Bob thought the question didn't surprise her. "A security team sanitized it recently."

"That's good. I have several sensitive things to discuss with you. First of all, we're conducting a weather control experiment right now. One of our scientists has found a way to use the powersat maser to modify the weather. Right now, we are starting a process which will prevent that new hurricane from moving ashore into Mexico." He stopped.

"That's some trick, if it works. Will it?"

"It's already being done, Senator." Time lag didn't make Earth-Moon conversations impossible. If neither speaker had an urge to make constant interruptions, then fairly normal conversations could be conducted. It made an excellent case for good manners, Bob meditated.

Neuthal remained silent for several seconds, and Bob could tell that she understood the implications of what he said. "What will become of the storm?"

"It'll stay at sea. In a few days it will break up and die, when it gets to the northern Pacific. That isn't all." Bob caught his breath. "We're still doing research into genetic engineering. Recently we have found cures for two genetic diseases: sickle-cell anemia and Perkins' Syndrome. They've been tested on humans and they work. Other experiments are close to success." There, he had it all out.

"I can't imagine why you're telling me this, Mr. Director."

"Simple. I want to make a deal, an arrangement. Let me draw an analogy. Do you know what a power inverter does?"

"Vaguely," the voice from Earth said. "It's some sort of electrical converter, isn't it?" She sounded perplexed.

"That's right," Bob assented. "It turns one kind of power—direct current—into another form of power—alternating current. Senator, up here we colonists have a lot of scientific and technological power. The trouble is, we can't apply that power to do the things we want done. We need some way to convert it into political power. That's where you come in."

"I see." Bob heard distrust in her voice. Something's wrong, he warned himself. "Mr. Director, you may be talking to the wrong woman. Tell me, have you ever heard of Grumbacher, Maine?"

"No," he said warily.

"I'm not surprised. Only the spectacular toxic-chemical disasters make

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the news any more." Her voice had turned sharp and biting. "My nephew and his family used to live there. Shall I continue? The details are most gruesome."

"I have an idea of what they must be." Fool! he berated himself. Only an idiot thinks that the enemy of my enemy must be my friend.

"So you'll have to excuse me if I'm not overcome by enthusiastic admiration. I'm a lot like my constituents. Every day we hear scientists tell us that this thing or that is safe, harmless, beneficial. Then sometime later they tell us that, oops, sorry, they were just a teensy bit wrong. Or they argue forever about whether or not something is safe to begin with. That doesn't inspire confidence, Mr. Director. It makes people wonder how safe anything is, when scientists are involved.

"Have you ever wondered why fusors were shut down? They leaked radioactive hydrogen—tritium, isn't it?—so much that the hardship of losing power, and all that implies, was much more acceptable than the danger of radiation poisoning. Perhaps you can imagine how my constituents feel when an automated factory takes away their jobs."

What to say? Bob wondered.

He suddenly realized that this woman was a typical environmentalist. She had a lot in common with the vast majority of the Verdants. Her concern was with the basics of life, and not the exotic philosophies and antics that entranced the media. Her skepticism of science had a basis in rationality, and that discovery convinced Bob that he could get through to her. He couldn't miss the fact that Neuthal, for all her hostility, hadn't broken the connection.

"Senator, science is a tool," he said. "It can be used for good and for bad, and it can be used carelessly. But isn't that true of everything? Including politics."

"Yes," she said wryly. "But the things you're talking about are dangerous."

"Not when they're used carefully. Senator, I told you that we've cured people of hereditary diseases, using genetic engineering techniques. If we hadn't done that, they would still be sick. Eventually some of them would die from their conditions. Is that dangerous? Stopping a hurricane—that'll save lives that Nature would have taken."

"But the risks involved! Good God!"

How could he make her understand? "Senator, there's risk in everything. Do you wear a bullet-proof vest in public?"

"No," she said slowly. "It's my way of telling the public that I trust them with my life. I worry some about crackpots, but I don't let them run my life. *However,*" she snapped, "It's *my* life I risk, and nothing more. Can you say the same thing?"

"I'm making this call. You could score points by stringing me up."

There was a pause. "They say you colonists are blunt. We've all been burned by science, Mr. Director. How do I know I can trust you? Why *are* you making this call? What's in it for you?"

"There are things to be done, Senator." He wished he could see her face. Bob needed the eye contact, and the feel that it gave him. In a conversation this important, not being able to see her handicapped him. "We can cure some

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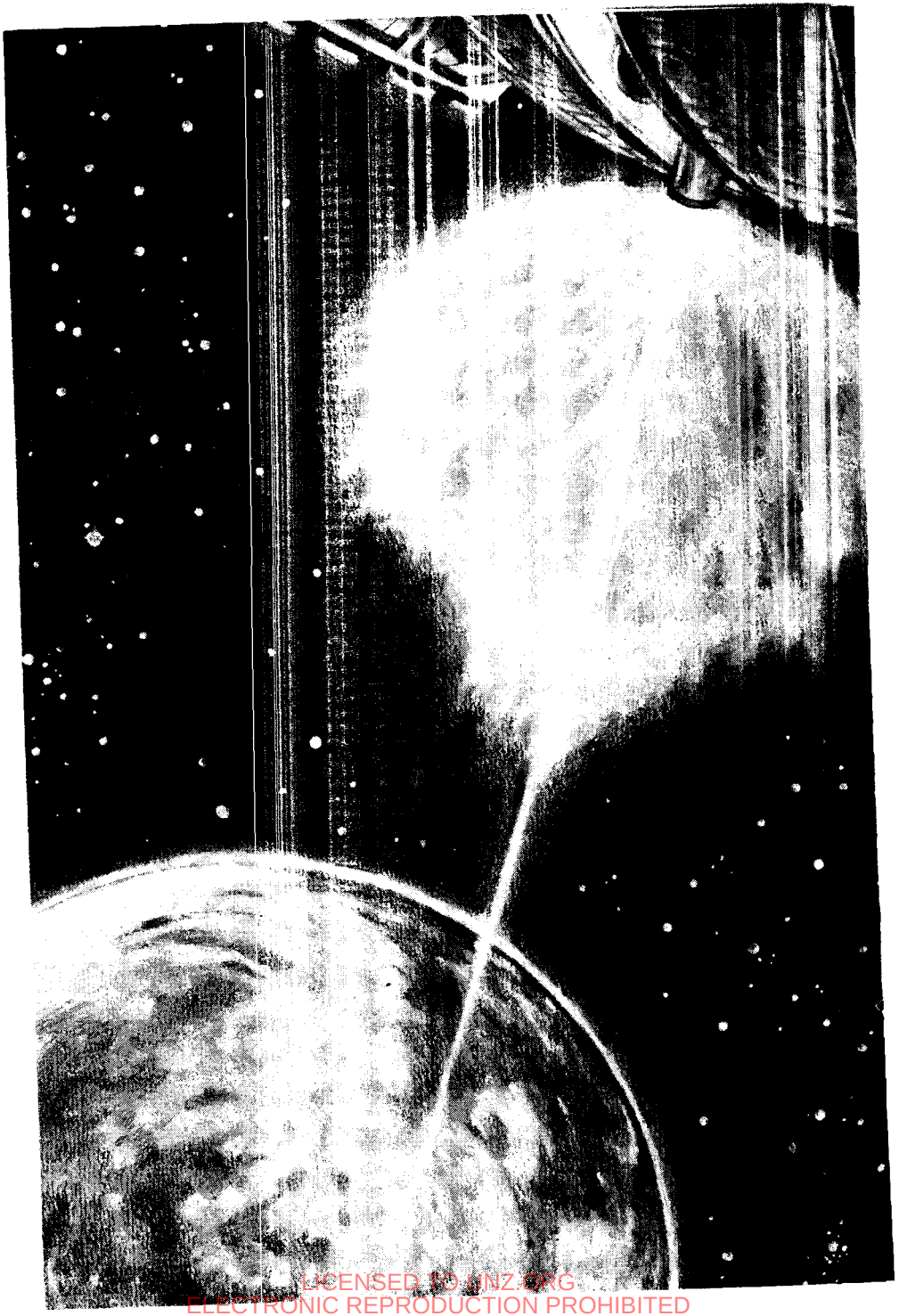

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diseases, and change the weather for the better. If things like that can be done, they should be done. Maybe I'll never get anything out of it, but I find this to be of overwhelming importance to me."

There was another, longer pause. Bob began to fear that she had hung up her phone, before she spoke again. "That's not exactly what I expect to hear from a scientist. I don't know what I expect. Why is that important?"

Bob considered his answer carefully. If his estimate of her was correct, she could answer herself. "What's your opinion of the speech Paravelli made last night?"

"Paravelli." Bob thought the name was dragged through clenched teeth. "That man is proof that going crazy is everything it's cracked up to be. Excuse me. My esteemed colleague merely said what a lot of people would like to hear. Times are hard down here; unemployment is up and money is down. There are those among us who cannot resist the temptation to exploit those conditions. Creating scapegoats—especially scapegoats who can't fight back—is an old trick. That little talk last night has done more to harm our relations with Mexico than anything since the Alamo—" She stopped short. Bob knew as if he had seen her that she had just pressed fingers over her lips in astonishment.

"Oh, my," she said at last. "Have you truly stopped that hurricane?"

Bob checked his wristwatch. "The operation began over an hour ago. We should be finished in a few more hours. We'll have to keep an eye on it until it dies—hurricanes change their paths pretty capriciously sometimes—but we can keep it away from land. There's no longer any reason for them to cause disasters."

"I believe you mentioned a deal."

Careful here, Bob cautioned himself. On wrong word could squelch this. "Senator, you still want to be president. I want to see that, too."

"Is that what you think you're offering me, sir?"

Bob observed that her voice was perfectly modulated. She managed to express her question without suggesting that she had been offended or interested. That was the voice of somebody with enormous skill and practice in dealing with people. Bob admired that sort of expertise, and found himself even more determined to make an ally of her.

"I'm offering you some aid in that direction, yes. Senator, I think that you see the office as a means to an end, not as an end in itself. Basically, I'm offering you the chance to associate yourself with something that a lot of people will find valuable."

"Yes . . . that could enhance my stature—if it works out properly. You haven't *proven* anything to me," she added cannily.

"I can. Send up somebody with sickle-cell anemia or PS, and we'll cure them. Contact the weather agency and ask them about the storm track; within twelve hours there will be a very pronoucned shift in its course."

"I see. Hm." Her voice had softened a bit, he thought. Neuthal sighed noisily. "Mr. Dubois, you are a most annoying man."

"I am?"

"You are. Thank the Lord I've never made any strong anti-science state-

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ments. As it is, you are forcing me to re-order some of my opinions. . . . Genetic engineering. That's slightly less popular than witchcraft." Bob heard a string of clicks, and he guessed that she was drumming her fingernails on her desktop. "I'll have to talk to Senator Hill. His granddaughter has sickle-cell anemia. She almost died last winter. But still—genetic engineering—"

"Think of it as medicine," Bob said. "People take medicine. They go to hospitals. Evidently they don't mind the fact that most medicine derives from scientific research."

"Unless something goes wrong. But genetic engineering has such a horrid reputation. . . ." Suddenly there was a feral note in her voice. "Hah. Sickle-cell anemia only affects blacks. Anybody who opposed a cure for that could be made to look unconsciously racist, no matter what their motives."

"I imagine that's true," Bob said uncomfortably. That sort of accusation would be unfair—but, he consoled himself, it would be even more unfair not to make the fruits of Helen's research available to whoever needed them . . . and mud-slinging was nothing at all like what he'd done to Hacker. "I guess it pays to consult an expert, Senator."

"I've always thought so. What else do you have to offer?"

"Many things. With some effort, we could create plants which could fix their own nitrogen."

"What does that mean?" she enquired.

"It means—" Bob caught himself before he could start a technical lecture. "It means lower fertilizer costs, less energy expended in preparing soil, increased crop yields and increased agricultural use of otherwise marginal lands. In other words, lower food costs and more food."

"In other words, happy farmers and happy consumers . . . and more tax revenues."

"Yes, Senator, it might be best if I sent a few people down there to brief you, and if you sent a few of your aides up here to investigate."

"By all means." There was a contemplative pause. "Your help won't assure my election, but it can be an asset. It goes without saying that this will get me tagged as the Science Candidate."

"You could always turn that around." He felt relief. She had accepted.

"No, but I can counter that in other ways. Leave my job to me, if you would." There was relish in her voice. "I do love a good campaign. Well, I'll have to send quite a few people to the Moon on junkets. I most fervently hope that you have someone up there who can deliver painless, informative talks to those among us who simply do not understand science."

"Well. . . ." Bob grinned, and suddenly was glad that Helen wasn't present. "Now that you mention it, I *do* have somebody up here who likes to lecture."

"Good." There was another pause, while static rustled from the speaker grille. "I would like to know something. What do *you* get from this?"

"What?" He felt bemused. It would be a blunder to hide anything from her. Besides, she should know the full situation. "An end to a lot of frustration,

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that's all. People up here feel strongly about some things, Senator. We look at our position and our potential, and we feel frustrated beyond endurance. There's so much we could do, and it's being left undone.

"It's an outlook we have. Paravelli has his outlook, but it only extends to the people who vote for him in his state, and no further. He's shown that he doesn't care about anyone else. Up here, we can't afford to be that parochial."

She laughed harshly. "Neither can we down here. Maybe we never could afford it—but don't quote me on that."

"I won't. There's something you should know. A lot of people are fed up with the way things stand now. We have an independence movement up here."

"Oh, my. Space industry is just large enough to be an important part of our economy, Mr. Director. Yanking it out could make the current boom-and-bust fluttering look like prosperity."

I'm glad she recognizes that, Bob thought. It means she realizes that she has to stand in our corner. "I don't think a revolution is likely now. With your help, and a few other things, it should pass. You see, people up here don't actually want independence. What we *do* want is to be the goose that lays the golden eggs. We want to get the eggs to the people who need them—and we don't want to wind up as *paté de foi gras*."

The Senator chuckled with delight. "And you need somebody to be your goose girl. I accept the job. I'll look forward to seeing your deputies. For now, I had better talk to the State Department. After this Paravelli disgrace, the Secretary will be most happy to have something decent to tell the Mexicans—and the publicity won't do me any harm." There was a brief pause, then: "Oh. One other thing, if you don't mind. How much can you do with this genetic engineering? My nephew's children . . . two of them are in institutions."

The change in her voice startled Bob. All at once she ceased to be a senator, and became an individual with grave problems—ones for which there were no solutions, and Bob had to say so. He swallowed hard. "Senator, I'm sorry. In theory we can correct some things, but they're relatively minor. Major, overt damage—from broken chromosomes up to physical deformities and neural defects—are beyond us. They're not even theoretically correctable."

"I already knew that, Mr. Director, but I had to hear you say it. Now I know that I can trust you. If you had tried to sweet-talk me—" The feral sound had returned to her voice, chilling him. But it vanished. "I'm certain we'll both enjoy a long and beneficial relationship. Now you must excuse me. You've suddenly given me a lot of work. Good day to you." The connection broke.

The relationship might turn uncomfortable, Bob thought. Earthside politics looked to be way out of his league . . . but this exchange had gone well. The Senator might dislike "scientists"—which was a vicious thing to call an honest engineer, he thought—but she could put that aside.

Bob wished he could relax, but there were more items on the checklist. He would have to extract some things from Orbmech . . . and he would have to

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make some concessions of his own, if he wanted to squelch the budding revolution. He hoped that he could match Neuthal's flexibility; the changes he would have to make in the colony's administrative system would give him more trouble than a mere revolution. After all, most revolutionaries simply shot the overthrown tyrants.

Then he began to grin. It would be much easier if Orbmech called on him for help, instead of the other way around. That would make them far more generous, he decided—and he could use the rebels to maneuver them into that. Then he saw how he could mix business and pleasure, and his grin turned to laughter.

The spaceport was a dimly-lit volume large enough to hold a small soccer stadium. It was poorly lit; full illumination would have taken an impractical amount of equipment and power. Anyway, Bob thought, the gloom added to the hangar's impression of vastness. People who had adapted to Port Goddard's tight halls, corridors and compartments found this place overwhelming.

Illumination came from open hatches, safety-lights on ship-sized airlocks, and portable lightbars. A set of lightbars stood guard around a lander, which had all of its access panels and cover plates sprung open. Bob heard a string of loud, cheerful profanity issue from the lander, and he traced it to an opening halfway up its white hull. "Scott!" he shouted. "Come on down!"

The spaceport manager wiggled out of the hatchway. He was in his element, Bob thought, as he watched Scott drop five meters to the hangar deck. Scott's goal in life was to work with spacecraft; his involvement in politics was secondary.

"I knew I'd find you out here," Bob said, as Scott touched down. "I didn't even bother to check your office."

" 'Course not," Scott said. He slipped a circuit probe into his pocket. "All I have there is more damned busywork. I've got a secretary to do that for me. Lets me worry about the important things."

"Uh-huh. But you really should spend more time in the office," Bob said. He didn't try to keep the cheerful tone out of his voice. "You're going to need the practice."

"Practice?" Scott scratched his head, and sat down on the lander's transport dolly. "Practice for what?"

"Government work." Bob leaned against the spacecraft's foil-covered landing jack. "I'm quitting. I've named you as my replacement."

"What!" Scott flushed red with outrage and jumped to his feet. He was still squawking as he drifted up, then back down: "I don't want your goddamned job! I'm an engineer, not a politician!"

Bob jabbed a finger into Scott's chest. "You became a politician the day you got locked into this independence thing. Who is it that buttonholes people to talk politics and economics at them? Who keeps singing the praises of autonomy? That's you, cratermouth—excuse me: Mr. Director."

"Don't say that! Somebody might hear!"

Bob smiled sympathetically. "I hope you enjoy it, and I hope you enjoy working with an advisory council. Democracy can be fun—it only took us

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seven years to agree on something as innocuous as a name for this place, remember? But I imagine you can improve on that record—with practice, eventually. Don't worry—the truth is, Scott, this job grows on you."

"So would a fungus!" Scott eyed him suspiciously. "You sneaky bastard, what are you up to?"

"Plenty." Bob decided that he'd thrown enough of a scare into Scott. "I know how we can get Orbmech to give us most of what we want."

Scott looked interested. "How's that?"

"First, we have to get your council organized." Bob gritted his teeth, then went on: "I'll gracefully knuckle under when I get that petition."

"You're not supposed to know about that." He looked quizzical. "And I thought you were against all that."

"I'm against independence, Scott—but so are you, and it's not just because you think you want to avoid getting stuck with my job. Tell me, how many people in space are independent? From one another, I mean."

Scott snorted. "None. Obviously."

Bob nodded. "We're all interdependent. If we became an independent nation, and somehow managed to stay that way, we might find it easy to forget our relationship with the people on Earth. We'd have the same sort of 'independence' that a hermit has."

Scott heaved a sigh. "I think I see . . . maybe it'd just be symbolic, but we might forget. I don't know." He sat down on one of the transport dolly's crossbars.

Bob sat down next to him. "Independence really means being able to do what we want. Anything else is window-dressing. That's why we're going to extort Orbmech. We need a council or something for that."

Scott looked befuddled. He wasn't accustomed to losing control of a conversation, and Bob didn't think he enjoyed the experience. "I don't get it."

"As soon as possible, you're going down to Earth. While you're following what promises to be a very busy timeline, you're going to visit the people in Orbmech's central office and let them know how likely a revolution is."

Scott contemplated that. "That's so crazy it must make sense."

"It does. I want them to think they're in danger of losing their investments up here. I also want them to know that I'm against independence. They have to believe that I'm on their side. That'll make it easier for me to deal with them."

Light dawned on Scott's face. "You're the good guy and the council's the bad guy. What are you going to twist out of them?"

"Part of their industrial capacity. The council will have control of that—and we're going to rig it so that everyone up here has a say in running the council."

Scott frowned. "That could be messy. Well, hell, we're supposed to be geniuses. We can manage some sort of responsive system."

"That's politics," Bob said agreeably. "Real politics. You'll like it, if you don't already. Now let's call the rest of your rebels together. We've got a lot to work out in a hurry." He stood up. "Lots of things are happening now—I'll explain them when we get everyone to-

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gether. I may as well start getting used to working with a council."

Scott stood up, and they started to walk toward the hangar exit. "So you're not quitting?"

"No. I just had to bludgeon some sense into you. I want to stay on as Director, even if I'm going to be subordinate to a committee. I like my job too much to quit." Suddenly Bob stopped dead in his tracks—then whooped and did a low-gravity backflip.

Scott misunderstood his exuberance, but he smiled. "No revolution. I guess you win after all."

"Huh?" Bob wobbled on his feet. He hadn't done any such stunts for a long while—since before Hacker's time, he recalled. He could never tell Scott about that, but . . . "You're right, Scott. I win."

"Hah! I finally cornered you!" Helen stepped into Bob's office, a determined look on her face and a medical kit in her hand. "I've been trying to catch you for weeks. Hold still, this won't hurt a bit."

Bob smiled wanly. "Pleased to see you, too, Helen. How are your guests?"

"They're running me ragged." She held up a scanner to him, and frowned at the hand-unit's readings. "I feel like a combination tour guide and school marm. Can you believe that you're the first patient I've seen since I got back from the outpost? I'd like to know whose bright idea it was, making me teach biology, genetics and scientific methodology to our honored guests."

"Sometimes these things just happen," Bob explained feebly. While Helen fumbled in her black bag, he looked at the torn shipping label fastened to his desk top.

Some time ago, after he had made his arrangements with the erstwhile rebels, Bob had written a long letter to Helen, detailing everything that had happened. He would have preferred to make a radio call, but secrecy had been a problem; he had been forced to settle for sending the doctor a hand-written letter.

A nervous week later, a rolligon had returned with her reply: "You did great. Keep at it. But why are you bugging me when I have a patient?" Few things in his life had moved him as deeply as the faith implicit in her scrawled words.

Bob forced himself to return to the here-and-now. "Dr. Iizuka is in your spot, too," he told Helen. "He hasn't had any rest since this thing started. He says it's bad enough having to explain how weather control works, but it's worse to have people tell him how valuable it's going to be." Bob smiled wryly. "Yesterday an executive type spent three hours telling him how it could lower insurance rates, cut heating and cooling costs, and other thrilling things. Compared to you two, though, I've had it easy."

"Is that a fact?" Helen tried a second instrument on him, and her frown deepened. "You'd have to be dead to be healthier than you are now. Are you through brawling with Orbmech and the Council?"

"Brawling? What brawling?" He laughed. "No, the negotiations weren't that bad, but they did drag for a while. I think Orbmech convinced itself that the situation was similar to any other labor-management dispute. They made concessions, just as if they were dealing

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with an Earthside union threatening to strike."

"What about the rebels?"

"They acted pretty implacable for Orbmech's negotiators, but I don't think most of them want to rebel now. They've realized just how tricky politics can get, and they're not eager to take on more than they can handle. Besides, they have most of what they wanted: power, and the means to apply it." He stretched his arms and tried to work a crick out of his shoulders. He didn't need Helen's instruments to confirm that he was worn out. "Right now, we're all approaching this as a matter of research and development. We all need more experience here."

"That's sensible." She pulled a hypodermic from her bag and loaded it.

"I'll say. Orbmech gave the Council control of five percent of the consortium's gross income. That's a lot of power—and you should hear them argue over how to allocate it! Orbmech is happier than they are. Most of that money is going to find its way back to Orbmech, when we buy things from them. They can still take that five percent as a tax loss . . . and they can get some free publicity out of the things we'll do with what we have."

"Uh-huh." She made an adjustment on the sprayer. "But what about the Verdants, Bob? I keep expecting them to crash and burn all over us."

"They won't. You see, we've been wrong about them. The average Verdant isn't a radical who wants to live in the Stone Age, or who thinks that machinery has dehumanized us. The average environmentalist is just somebody who's basically an average citizen. He's afraid of what can happen when science and technology are misused by us. He's afraid of dangerous things and carelessness. Sure, a lot of the anti-science feeling grows out of ignorance, but in their way they think they're working to make a better world down there. Just like us, in a way."

"But you don't do that by outlawing progress," Helen said. At a gesture from her, Bob rolled up a sleeve, and she sprayed something into his arm. "There's a difference between being cautious and being paralyzed by fear."

"Yes," Bob said tiredly. "But their world is so safe that they've forgotten how to live with any sort of risk." He yawned, then looked at her. "What was in that shot?"

"Doc Helen's Overdose for Overworkers," she said. "It'll put you back on your feet, right before it flattens you. You need rest, Bob. Either that, or you should sue your embalmer."

"Well, I can afford to rest for a while." He stifled another yawn. "I was about to say that a couple of the far-out Verdant groups were going to make trouble for us. They went to the Attorney General and tried to start something. It didn't work out for them." He massaged the injected spot on his forearm.

"Well, why not?" Helen demanded.

"Neuthal had a talk with the AG before they did," Bob said. "She convinced him that any charges filed against us would be so riddled with holes that they couldn't hold air. That may not have been entirely legal, but it worked. One reason it worked is that Neuthal has a lot of backers now, people who think of her as the woman who made available

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weather control and the sickle-cell and PS cures. It's a tenuous connection, granted, but it gives her power."

"But if the Verdants want to get us, they won't let one defeat stop them."

Bob shook his head. "That's another reason we're safe. Anyone who wants to blast us is already defeated. The few fanatics who saw the AG are in disgrace with the rest of the movement. The environmentalists are basically decent, and when they see pictures of kids having their lives saved, or see how we shoved that storm out to sea—you've seen the tapes, haven't you?

Helen nodded. A weather satellite had taken a series of photos of the hurricane's movements. Turned into a time-lapse movie, the pictures revealed the unmistakable bend in the hurricane's path. It made for potent propaganda.

"Only fanatics can argue that's evil," Bob continued. "By their logic, it is—but most people care more about the good we've done. It's something they can accept. That makes attacking what we've done political suicide." He rubbed his eyes; keeping them in focus had become difficult. "They haven't had any great change of heart about science down there. Maybe they never will, but that doesn't matter. What counts is that we've had a solid, definite, undeniable impact on Earthside events. Nobody has to die or starve or become a refugee anymore because of hurricanes. In a few months we'll have eradicated a few diseases. Knowing that feels good," he added. "You know, Helen, I think I'm beginning to enjoy politics."

Helen gave the hypodermic an awed look. "This must be stronger than I thought. Don't you claim to be an engineer?"

"Oh, I am!" Bob leaned back in his chair and regarded the overhead lights. To his surprise, the silvery biolights were back on. Had a month passed already? "It teaches us engineers to accomodate ourselves to the real world," he said. "We're supposed to work with the available materials under the prevailing conditions. Now, if I have to work with misunderstanding, ignorance, greed, political machinations or bull-headed idealism—so be it. I'll do that, and I'll find a way to accomplish what I want. Politics is just engineering with people."

"I see." She put the hypodermic back in her bag, and fished around for something else. "You should get some sleep now. If you're still having nightmares, I can give you something to alleviate them."

He shook his head and smiled slightly. "I haven't had the chance to tell you yet, Helen. I've stopped having nightmares about Hacker. I'll never have them again."

"That sounds definite," the doctor said. "I hope it's true."

"It is." He stood up, unsteadily, as the shot began to take hold. "We almost had the answer, the last time we talked. Remember that you told me that living in this deadly environment had caused us to place a high value on human life? All human life, from our best friends to people we've never seen and never will see. That has to include our enemies—demagogues, radical Verdants, even Hacker. They're all human beings as well."

Helen nodded thoughtfully. "So your

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unconscious rebelled at the idea of attacking someone who, logically, had to be destroyed. But can you tell me why recognizing that should end the nightmares?''

''I'm not sure I understand it myself.'' He started clearing off his office couch. It would make an adequate bed; he didn't think he could walk as far as his quarters. ''Hacker had an intrinsic worth as a man, but I had to destroy him. At last I've been able to prove to myself that I did it to defend something of value to humanity; lives are being saved because of what we've done up here. I destroyed him for a good reason, and not to protect my career. I'm not another Macbeth. My conscience feels clean now.''

Bob lay down, and started to drift toward a deep, untroubled sleep. ''All these years,'' he said quietly, ''We've been telling ourselves about the dangers of space. But those some dangers have forced us to use our minds, all the time—and to become more human. That makes space a very friendly environment.''■

● Our December cover, by Jack Gaughan, goes to a long story by a new author, Geoffrey A. Landis. It's one of those stories that's hard to pigeonhole, but too much fun to pass up. Suppose a technology of magic were developed *in addition* to that of science (and there are faint indications in recent quantum mechanics research that the two may not be as far apart as we've thought), and both types were used side by side. Some interesting problems can arise; I won't tell you any more about what vulcanologists, spaceport technicians, and Italian peasants have to do with each other, beyond mentioning that the title of the story is "Elemental."

Dr. Stephen L. Gillett's fact article, "Second Planet—Second Earth," might be viewed as distantly related in subject matter, though the emphasis is more on pure-science-as-we-now-understand-it. A funny thing has happened to scientific categories since man-made machines have started exploring the other planets of our solar system. Those distant chunks of real estate, once strictly the province of astronomers, have been largely appropriated by geologists, one of whom here considers the current prospects for terraforming Venus.

IN TIMES TO COME

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Joseph H. Delaney

THUS BEGAN THE DEATH OF DREAMS

Solutions have
a way of creating
new problems—which,
with luck,
just may in turn
suggest new
solutions to
still older problems.

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The boardroom of Bass Pharmaceuticals Inc. was nearly as old as the company, which had been founded by Dr. Noah Bass in 1932. Light came from two chandeliers hanging on chains from the ceiling, each centered on one end of a long oval table, built of sturdy oak and resting on clawed feet on a Persian rug. Demons covered the walls, carved in bas-relief into thick panels of dark walnut. The room exuded gloom.

Clustered in little knots, some whispering in hushed tones behind cupped hands, the directors waited. The severe wooden chairs which surrounded the table, padded only at the seat and back with thin, wool-stuffed fabric and decidedly hostile to the human form remained, for the most part, empty.

The door opened. Through it entered Elliott Bass, chairman of the board; several of the company's officers; and a tall, cadaverous man whom no one recognized. Silence reigned, as directors slipped into seats around the table.

"This special meeting of the board of directors of Bass Pharmaceuticals, Inc. is now in session. The secretary will call the roll."

Bass stood, waiting while this was done, then spoke: "The purpose of this special meeting, to put it very, very bluntly, is to find a way, if we can, to avoid bankruptcy.

"We have lost, in the first two quarters of this year alone, over $128,000,000.00; more than ten times the capital my grandfather had when he founded the company, and more than the gross annual sales of any year while he was chairman. The projections for the third and fourth quarters are worse.

"Foreign competition has driven us out of overseas markets, and now threatens our domestic market position. Government red tape delays the introduction of new products we have under development now, and which might have saved us had we been able to market them sooner.

"Since there appeared to be no other avenue than austerity open to us I hired, at my own expense, Mr. Sybert Morner, the gentlemen seated behind me, to make a study of our situation. Mr. Morner has certain suggestions to cut our costs and improve our efficiency; suggestions which seem sensible to me. I have asked him to review these with you, and when he has done this, it is my intention to move this body to replace our present chief fiscal officer with Mr. Morner. Mr. Morner, you have the floor.

Morner rose, a bound report in one gangly hand, a pencil in the other. He gazed out across the table through dark, deep-socketed eyes, framed in taut pale flesh stretched across bony cheeks. His voice, deep and mournful, fit the gathering's funeral mood.

For a half hour he eulogized the company, recounting the moments of fiscal greatness in its past. But then the table became a catafalque. He began a careful, though highly critical analysis of its affliction.

Finally, he proposed a cure—a cure which, he said, might enable the corpse to rise and walk again: cut waste, trim payrolls, abandon unpromising research, drop unprofitable lines, retrench in strength and rise—slowly.

When he was finished he sat. He waited. Then came the vote. Men and women, now pale, frightened by his

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words, visualizing bales of worthless stock piled in closets, rotting and moldering, gave this, their savior, his mandate. Thus began the death of dreams.

"No!" What *are* you doing? You can't go in there."

The man was great in stature and mighty in girth. Moreover, he had acquired a great deal of momentum in the short time since he had begun his charge across the reception room. He looked straight ahead, eyes bugged behind thick wire rimmed lenses, face resolute beneath an unruly red beard. Behind him, the tails of his white lab coat trailed in the not inconsiderable breeze his passage created.

Bea Kassett was brushed aside, struck with a glancing blow of his abdomen, and tumbled backward. She landed, dumbstruck, on her rump, legs apart, dignity shattered. Her hands flew to the hem of her skirt and struggled to preserve what small mystery that severely slit garment concealed.

The man rushed on, crashed the leather padded wooden door without even attempting to turn the knob. Its jamb, penetrated only by a token bolt, yielded to the warping bow his assault produced, and popped through the thin coping.

The next obstacle, an antique rocker, given Sybert Morner by his mother, which had graced every office he'd had since, splintered on impact. It had occupied a place of honor directly in front of his desk.

Striving mightily, hands outstretched, now sliding across the top of Morner's desk, seeking purchase with which to brake his body on its mass, the man slowly brought himself under control.

Morner, startled at this abrupt and violent entrance, had first looked up from his papers, then sprung, backward but erect, rising like a defending cobra over a clutch of eggs. His face, not an expressive one to begin with, retained his customary placid look. But something about that look; those piercing, unblinking eyes, added to the reptilian character of his actions.

This had the usual effect on his visitor, whose resolve to come here, born of desperation and fortified only by the fact that his great body, once in motion, was difficult to stop, crumbled away. "You can't kill Morpheus," he screamed.

That broke the spell. Morner acted at once, glancing at the door where Bea Kasset, now back on her feet, stood with the telephone receiver in her hand. He nodded to her. *Security would be here in a moment.* Assured of that, Morner sank back into his chair.

"Who *are* you?"

"Hopper. I work downstairs; I'm—I was—in charge of Morpheus. You can't kill Morpheus, Mr. Morner."

Morner had handled nuts before; never one quite this large, to be sure, but he was no virgin. He knew that they were awed by calm manners and that they craved attention more than any other thing. In the moments it would take for security to arrive Morner could spare a little of that. He looked across the desk at Hopper, who had suddenly started to sweat profusely, and whose hands were now creating unsightly smudges on the glass desktop. "Sit

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down, Mr. Hopper; I don't like looking up at people when I talk to them."

"It's *Dr.* Hopper." He backed off; looked down at the ruined rocker, which, had it survived, would not have held him anyhow. "Sorry about the chair. I'll get it fixed." He reached over and dragged a more substantial chair from the other corner.

"Who is this Morpheus? Why would I want to kill him?"

"Morpheus is a gibbon."

"A gibbon? An animal?"

"An ape. Uh—and it's also the name of the project I was working on. The one you ordered cut."

"I see. Well, yes, I believe that I *do* recall that name. But then, we had to cut many projects. The company is in grave financial distress, Dr. Hopper. It may well go under. Surely you can understand that unproductive—"

"Morpheus isn't unproductive, Mr. Morner. Morpheus can *save* the company. Morpheus is the biggest thing to hit the pharmaceutical industry since penicillin."

Where WAS security?

Morner's failure to respond enthusiastically to that remark disturbed Hopper. He launched into a desperate diatribe. "I know my department head doesn't believe that, and neither do you, but neither one of you know what's really been happening. I—I uh—wanted to be sure before I said anything, so yesterday, I tried it on myself."

"Tried what on yourself?"

"The process—I didn't sleep at all last night."

You and who else, said Morner to himself. "So?"

"I won't sleep tonight either, or tomorrow night, or ever again."

"What?"

"Morph hasn't even *closed* his eyes for sixty-seven days."

"I see."

"No, you don't. I can tell. You have no appreciation of what that fact implies."

"Suppose you tell me." Morner knew he wouldn't have to endure much more. Looking out through his ruined door he could see Bea creeping closer behind two tiptoeing security men.

"I can keep going around the clock. I never get tired now. I don't waste a third of my life lying flat on my back doing nothing. I can produce something with every minute. So could our production workers. We could get by with one shift; save millions; end competition with our lower prices."

Morner rose. "Excuse me, Dr. Hopper. Miss Kassett, tell those gentlemen to wait outside, and close the door, please." Hopper's words had struck a responsive chord in him, and he could now tell that the danger, if there had ever been any, was over.

He sat down. "Now, Dr. Hopper, you interest me. Tell me more."

"It's a breakthrough, Mr. Morner. Like I said, I wasn't certain until yesterday; now I am. I'm OK; and Morph's OK. Of course, I'll understand if the company wants to do some more testing with other volunteer subjects, but—"

"Go on."

"Well, the way I look at it, the place to begin is right here at Bass. We could start with the research staff; convert them. That's give us an advantage over the competition right away. They'd—"

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"I want to hear about the product first; then we can go into detail. Just what is it you did to yourself?"

"I burned out my sleep center."

"What?"

"I know; nobody knows what a sleep center is. Science never acknowledged its existence. That's because they didn't understand what sleep was, or why it was necessary to higher life. I guess, if you come right down to it we still don't, but then that's only one more mystery. We don't know why aspirin works either."

"How did you do it?"

"Papaya juice."

"What?"

"We use a substance derived from papaya to digest the sleep center."

"I see."

"It's like the drugs they use to treat back conditions: same source, similar properties, but a different fraction. You know how that works, right. They inject it into the intervertebral spaces and it digests protruding disc material. That's a relatively gross procedure compared to what I do."

"And just what is that?"

"I can put it in anywhere, through the venous system. I use a tagged molecule."

"I'm not a scientist, Dr. Hopper—"

"I know. I'll try to keep it simple. You see, the brain is a rather complex organ, but its basic nature is electrochemical. Very, very tiny fractions of chemical substances regulate its behavior. These range from hormones produced in glands like the pituitary and the pineal, which control bodily functions, to such substances as endorphins, which appear to act only on the brain itself.

"It was these substances I was investigating when Morpheus began. I'll admit that it was not a high priority project to start with. I was seeking a better treatment for narcolepsy, which is a comparatively rare condition without much of a market. However, it seemed to me that we ought to be able to find something better than amphetamines to handle it. Uh—my mother has it, you see.

"Anyhow, I began searching for its cause, and trace substances seemed to be the most logical suspects. Animal studies provided the first clue, and I found an area of the prebrain where certain of these substances appeared to concentrate at regular intervals. Such concentrations appeared nowhere else. Moreover, the intervals between maximum concentration coincided with periods of sleep in the test animal. It was apparent the body disposed of them during sleep, because animals killed and examined right after waking lacked such concentrations.

"I never succeeded in isolating any of the substances, though I know there was more than one of them, but since there seemed to be a relationship between them and a particular physical location I next tried surgical removal. That invariably killed the animal.

"In an effort to reduce the volume of tissue destruction I tried the standard digestive preparation, introducing it through a catheter, and allowing the capillaries serving that area to disburse a small amount of it. This killed most of the test animals too, but one or two

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survived for a short time. *And*, they no longer slept.

"So, I refined the process. Fifteen months ago I happened upon my present technique. I tested it for a year on mice, guinea pigs and rabbits; then I got Morph. Morph has not slept since, and he stayed healthy. I hadn't intended to go to human subjects quite so soon, but then I got the news you were closing me down. I couldn't wait. I had to try it, either on Mother or myself. Naturally, I chose myself."

"You—uh—you *look* OK."

"I feel fine. I still get tired, but all it takes is a few minutes of inactivity and it's over. In the meantime, it doesn't seem to matter how active my mind is. Mental effort isn't especially fatiguing unless there's a corresponding physical need for rest. I find I'm more alert, and alert almost continually. It makes a big difference in my work."

"I see. All right, assuming everything is as you say it is, Dr. Hopper. There's still the problem of translating it into money, and the bottom line *is* money."

"I'll have to defer to your expertise in that matter, Mr. Morner. But, it seems to me that if we had a research and production force that never slept—"

"—And how do you get these people to submit to treatment; and how do you ensure they'll stick with the company afterwards; and how do you get a thing like this past those cretins at the F.D.A., especially since we know that lack of sleep causes mental aberration.

"That's just it, Mr. Morner; we don't know any such thing. Nobody knows why we sleep, or why any other animal sleeps, for that matter. There is a theory—an old and very controversial one—that the function of sleep is to let the brain catch up with its filing, edit its memories, work out conflicts, and so forth.

"But I don't buy it. Most knowledgeable people don't. Because nature isn't wasteful, and evolution doesn't install systems in its creatures that have no function. So, I ask myself; how much filing does a frog have to do? How many conflicts does a fish have to work out? In other words, if it doesn't serve that purpose in man's precursors there has to be some other reason why they do it.

"I won't say there aren't risks involved. Far from it. But, I am saying that I haven't encountered any problems I haven't been able to handle. Now, maybe other people will, and there could be some waiting for *me* further down the line, but there's no way to tell until I get there.

"Of course, it's also possible I'm just a physiological freak or that my process takes care of the problems some other way which we don't yet understand. At this point I know it works, and I pretty much know 'how,' but we'll need a lot more testing before we know 'why.' "

"Oh, the F.D.A. will test us to death—I can guarantee that, and this is only one of dozens of things we'll need to overcome to make your scheme work. How do we get past all that?"

"Uh—I don't know."

"I don't either. But everything I mentioned seems to me like an insurmountable stumbling block to what you propose. Out of all of them, the government would be the worst. Government interference put this company in the shape it's in. Without it, we could

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go on the market with half a dozen drugs the Italians, Japanese and the Swiss don't know about. They're our main competition; you know that."

Hopper did. Everybody in the business had been weaned on the story of Mussolini's famous decree, the one that had wiped out patent protection for drugs in Italy. The Italians never repealed it. They liked being able legally to manufacture and sell bargain-basement pharmaceuticals. For a while their biggest customer was the U.S. military. Required by law to purchase the cheapest suitable products, they were also compelled by American law to ignore patent infringements committed against domestic drug companies.

The Japanese competition came later but was even tougher. They not only excelled at duplication of research; they were innovative and resourceful enough to open up new avenues of research. Their celebrated efficiency only made it worse.

"It's the only way, Mr. Morner. I—"

"Let me think it over, Dr. Hopper."

"What about my project?"

"Your project is safe—for the moment. Listen; who else knows about *you?*"

"Uh—if you mean, my—my own condition, nobody. I didn't tell anybody. But there are a few research people, mainly my own assistants, who know about Morph. They're—"

"I hope you're going to say they're reliable. Are they?"

"Sure. Their jobs depend on keeping quiet. They know that."

"See that they understand their continued cooperation is expected. Go on back, round them up, and tell them their jobs are safe. We don't want any of them cutting out and joining the competition."

"Uh—yes—sure. They'll be glad to hear it. Does this mean . . . ?

"I'm carefully considering what you've told me. I'll be in touch."

Hopper left, feeling somewhat better. He could not tell for sure whether Morpheus was really safe, but he had hopes.

So did Morner. He dismissed the security men from his office, but called the chief and ordered surveillance on Claude Hopper and all his assistants. It was routine in the industry to check your people periodically. You never knew when your most promising reserach was going to find its way into the hands of one or another of the industrial spies who preyed on companies like Bass.

"Mr. Morner; You understand, I'm a busy man; I can only give you a couple of minutes."

"I do, Mr. Secretary, and it was gracious of you to see me. I shall try to be brief." Morner sat, in response to a gesture. He had taken the measure of the Secretary of Defense, found it well within his manipulative capability, and planned his attack, all in a matter of moments. There was more of the snake in Morner than anyone imagined.

"I offer this country a decided military and economic advantage, Mr. Secretary. I propose to give it defenders who never sleep, workers who never tire, and who, in addition to this, do not consume valuable resources while they produce."

They Secretary's eyes bugged; his mind raced. *Who was this man?* His appointment secretary had referred to

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him simply as a representative of a leading drug company, but, he could well be a madman, judging from those remarks. Nevertheless, he struggled for composure. "This department is always interested in things which enhance our efficiency, Mr. Morner. I take it you have some new drug?"

"Not exactly. I'm afraid I can't go into details right now, but, Bass Pharmacueticals has a number of people in its employ who no longer sleep at all; who can devote their entire energies to their work on a more or less continual basis; who require no housing whatsoever; and who consume nothing but food and clothing.

"How would you like to have an army like that?"

The Secretary stared at Morner for a moment; then he blinked. "A drug that can do that?"

"Not exactly a drug; a secret process. One that'll stay secret just as long as we want it to."

"I see. What is it *you* want, Mr. Morner?"

"Why, to do the patriotic thing."

"And—?"

"To earn the gratitude of my government."

"Go on, Mr. Morner."

"Under normal circumstances we'd try to market a thing like this. You can see how it would have tremendous commercial value. But there are a couple of other considerations which have caused us hesitation."

"I'm listening."

"First of all, the process has an upper market limit, despite the fact that demand would be worldwide. The fact is, it's a one shot affair. Once used, it's good for life, at least according to our present lights. After that, additional revenue would depend on the planetary birth rate."

"I see. There are some more reasons?"

"Yes. In addition to the obvious fact that it might be important to national security, we couldn't begin marketing it without approval of certain federal agencies not known for speedy decisions, *if* you know what I mean. And I'm afraid Bass has some rather serious financial problems at the moment."

"Uh-huh." The Secretary now had an insight.

"Yes, well, Mr. Secretary; that sets the stage for a solution—of a couple of problems, including certain difficulties we'd ordinarily anticipate in protecting our process from theft."

"Theft? You mean from spies?"

"Exactly. Not just the traditional kind you have in mind, either, although they'd surely be at it. But, you see, industrial espionage plagues drug companies. It's even more pervasive in our business than in such things as electronics and space technology. That's because it's easier to get a competitor's employees to sell out. They don't look on it in quite the same way they would if they sold missile plans to the enemy. Drugs are regarded as pretty much humanitarian by nature. Some thieves even brag about having shortened the route for suffering patients.

"You can easily see what that does to the poor businessman who depends on profits to support his research."

"Of course."

"So, the bottom line is, Mr. Secretary, that in return for protection, and

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in return for a fair price, Bass Pharmaceuticals would be willing to provide D.O.D. with sufficient dosages of the drug to convert whatever forces the government wishes. The process would remain a trade secret, of course."

The Secretary no longer stared at Morner. Now, he smiled. Morner, he had concluded, was not a nut, but simply another hard-headed businessman with a product to sell. And it was a product which, if it measured up to the promises he'd just heard, would certainly be worthwhile having. He picked up his phone; punched the com-line button. "Cancel everything for the rest of the day; hold my calls."

"Now, Mr. Morner," he said, placing the receiver back on its cradle. "I'd like to hear the details of your proposition." Already the Secretary had visions of atomic aircraft bristling with missiles, capable of remaining aloft for years, guarding the country. He saw nuclear subs, carrying twice the present armament and one third the personnel. He saw armies without barracks, marching continually, trained to absolute perfection, capable of enduring combat strain for years on end. And he saw himself, nobly submitting to the drug, manning his office with tireless efficiency around the clock."

By the time "Sy" left, he and "Henry" were like old friends. And —they had a deal cut; one that Congress probably wouldn't like, and therefore would never hear about from them.

"Good morning, Claude." Elliot Bass popped his head into Hopper's plush new office in he executive suite. Hopper was buried up to his elbows in papers.

"Is it?"

"A good morning? Yes, I think so. The weather's nice outside and all."

"No, I mean, is it morning? Lately, its been getting sort of hard for me to tell. Things run together. Maybe I should have some windows put in here, so I could keep track."

"Go ahead, if that's what you need. Nothing's too good for my chief of research. Thanks to you, the company's on its feet again."

"I can tell," Claude replied, wryly. "It's certainly producing enough paperwork."

"Well, that's to be expected. Most of our top people have converted. They're producing more, and that's what we wanted, wasn't it?"

"I suppose. But you know, I'd really like to get outside a little more. I can't. I'm afraid, even with all those guards around me. They tell me the KGB has put a price on my head."

"I hadn't heard that. Could be, though. I'm certain they have it figured out by now. We put them in quite a spot. But, I think you can rest easier now. Henry tells me we've managed to tighten things up, now that we have the manpower to police our borders. They've even turned off that flood of wetbacks down in the Southwest."

"My mother died," said Hopper sadly. "I couldn't go to the funeral. Too hard to protect me, they said. Poor Mom! She didn't know what to do with all that time. I should have let things be."

"Everything has *some* disadvantages, Claude. Nothing's perfect, but, when the country adjusts—well, it'll be a better life."

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"I hope you're right, Elliott. Uh—did you want to see me about something?"

"Yes, Claude, I did. Claude, we may have a little problem coming up. Nothing major, and it's a little ways off, but maybe it's time you looked into it."

"What kind of problem?"

"Well, Henry brought it up at lunch the other day. It's those military people we converted."

"What about them?"

"Some of them don't want to re-enlist."

"I thought they had to. Wasn't that part of the agreement when they were converted?"

"Yes. But it applied only during our 'emergency' situation, and only to able-bodied people. There are a few whose profiles have changed, and Congress is getting sticky about extending the President's authority to keep us mobilized."

"So? Why don't they just discharge them?"

"Henry's a little scared they might wind up on somebody's autopsy table, for one thing. And—"

"Autopsy will tell nothing about *how* we do it; just that we did *something*."

"Well, maybe that risk is exaggerated, Claude, but there are other things. There are some people who are worried about the effect on the economy if enough of them get out and enter the work force."

"It'll be years before that's a serious problem, Elliott. It seems to me that's within our control anyhow."

"Maybe so, Claude. The point is, it's a risk—a small one, granted, but one we shouldn't be taking. Claude: I want you to get to work on a reversal process."

Hopper pushed a stack of papers aside, removed his glasses, and began polishing them with a handkerchief. "Elliott, the process is irreversible. Once you're done it you can't turn back. Even if we understood the chemistry there's no place for the stuff to react. The part of the brain it reacts with is gone."

"I want you to try it anyway, Claude. We want it, just in case."

Hopper looked annoyed. He wasn't quite certain he understood Elliott anymore. Elliott used to be an easy going guy: a guy who never gave orders, who only made suggestions. And that had been what Hopper liked about him. Now, here he was, telling the man who saved his company to find a way to cancel the advantage he'd given it. It didn't make much sense, but then, Bass wasn't a scientist. He wasn't even a business man. He was just a monied parasite, whose ancestors had guessed right about a couple of things. But, to get rid of him, Claude promised to put a team to work on the idea.

"Henry, how are you?" Morner also had a new office, and the office included a brand new videophone, just like the one Henry had. The trouble was, these were still scarce, so most of the time Sy couldn't use his.

Henry's face wore a troubled look, one that wasn't the product of electronic distortion. Neither was the urgent tone of his voice. "Where's Hopper, Sy?"

"On vacation—somewhere up in Washington State. He'll be back next week."

"Don't be too sure, Sy."

"What's that supposed to mean?"

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"We were keeping track of him, Sy; *Were!* We lost him."

"So. Maybe he just got tired of looking back and seeing your people snooping. Claude's gotten a little sensitive lately. That's why I insisted he take a rest in the first place."

"*You* suggested it?"

"Yeh. Besides, Elliott wanted to get into Claude's records, and find out if he was dogging it on the reversal research."

"I see. Was he?"

"No. Not as far as we can tell. Looks like he's working hard at it."

"Well, he'd better be. Things are getting stinky. With the Russians out of the way the President's going to have to give in, and the end of the emergency means we'll be dumping a lot of military people out on the civilian labor market."

"What do you mean 'with the Russians out of the way'? There's still a civil war over there."

"They're killing each other with knives and axes, Sy. Their offensive capability's gone."

That was true, Morner thought. They'd ruined their economic system trying to keep up, then fallen victim to revolt of their own satellites. "Look Henry, we'll find Claude, all right? It'll be OK."

Henry didn't look convinced when he broke the connection, and time would prove his fears well founded.

"Sy—are you positive? Guatemala? What would Claude be doing there?"

"Evidently, he's running from us — now. But Henry thinks he's got bigger plans; that he means to start himself a popular revolution down there. Elliott; we should have watched that man closer. He's a weird one. I knew it the minute I first laid eyes on him."

"You knew?! You were the one who twisted arms to keep him on. This whole mess is your fault, Sy; yours and Henry's. Uh—I suppose Henry's the one who found him?"

"No. I had our own people do it, after Henry called me. I think Henry's slipping his gears too. He may not be around much longer from what I hear. He's got a lot of enemies in Congress."

"What's that supposed to mean?"

"To you—nothing, Elliott. Look—you let me take care of it. I told you so you wouldn't hear it from somebody else, and blab it around where you shouldn't. Keep your mouth shut and things will be all right. I'll handle this."

"*I'm* chairman!"

"For the moment. Remember those stock options? And there were a few of the fainter hearted investors who didn't believe in Hopper as strongly as I did. I've got control of fifty-one percent, Elliott. You're chairman at my sufferance now."

"That is the fourth one in three days, Señor Hopper. They have sent an army of assassins to kill you. One day one of them will succeed."

"I'm not that important anymore, Alejandro. There are others who know what I know. They'll carry on if anything happens to me."

"But the people need you. You are our leader. You are doing what no one has ever done before."

Hopper paused before he replied, and thought about that. What Alejandro said was true. He *had* changed things. He

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had done it without killing and without bloodshed, but he had used threats of these. The padrones *were* coming around. They *were* making concessions. They were much more realistic than the Russians had been. They feared an army that never slept, a worker who never tired, an enemy who never forgot his ultimate goal was land, and who offered a choice between peaceful negotiation and revolution. "We will achieve our goals here, Alejandro, and then I must move on to other lands. And then the people must follow you."

Alejandro nodded. He had heard all this many times before, though never from a Yanqui. Always, when the time came, the leader stayed, and each time another rose to challenge him.

In time, Alejandro would regard this as a miraculous happening, but by then Hopper would be half a world away.

"No! No! Not them—not the Italians. Why? Why would Hopper do a thing like that?"

Bass Security Chief J. B. Grundy was not anxious to speculate on that. He was in enough trouble with Morner as it was, having utterly failed for seven whole months to track down and kill Claude Hopper. "Maybe it ain't him, Mr. Morner. Could be somebody else he trained."

"No, it's him, Grundy. I know him. He used it to get something from them; I *know* he did. That's the one thing he was willing to learn from me. But whoever did it, whether it was Hopper or somebody else, the whole industrialized world's in trouble now. If the Italians have it today the Japanese will have it tomorrow."

"What do you want my people to do?"

"Stupid question—find Hopper. I personally want the satisfaction of knowing that man's dead. Now, get going, Grundy."

"Yes sir. We'll get him, sir." Grundy literally flew out of Sybert's office.

Sybert picked up the phone, activating the screen in the outer office where Bea Kassett sat at her desk polishing her nails. She didn't know he could see her, a secret Morner had kept to himself until now, since Bea sometimes did other things he liked to watch. "Miss Kasset!"

Nail polish from the upset bottle poured across the top of her desk. The brush she had thrown into the air as a reflex to her start came down in her hair, and stuck there. "Yes sir?"

"Get the President on the phone."

"Yes sir; I'll try, sir." *He's flipped. You don't just pick up the phone and get HIM.*

Miss Kassett was wrong. Sybert Morner *could* do just that, and he did.

"Mr. President. Nice of you to talk to me. But, I'm afraid this call is bad news."

"Well, if you're going to tell me the Italians are making the conversion drug, I already know. I would have called you in a few minutes."

"Knew! How?"

"Confidential sources, Mr. Morner."

Confidential? Grundy! It'd be just like Grundy to sell out. You couldn't trust anybody these days. But Morner tried to keep cool. "I'm flattered, Mr. Pres—"

"Stuff it, Morner."

"What?"

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"I said, 'stuff it.' This whole mess was your doing. And it may wreck the country before we get control of it."

"Mr. President, I don't understand. The U.S. is king of the hill, thanks to me. If I—"

"—had let things alone we'd have been better off. My predecessor was a stupid man, Morner. Stupid even for that party. I'd have had you shot."

"See here, Mr. President, even you can't talk to a citizen that way. I'll—"

"You'll what, Morner? Listen to me. Do you know what's been happening out there lately? Don't you read the papers, watch TV?"

"Sometimes. I—"

"There's a depression in the making out there, and this Italian leak is only going to bring it on sooner. This country's economy will collapse in a matter of weeks, now, instead of in months."

"I don't see what—"

"I know. But that's because you haven't paid attention. Look, we've got over a million discharged soldiers and sailors out there, most of whom are competing for jobs with normal people. And whom do you think the employers hire? The converted worker, that's who. He can do more work. He's more efficient."

"But a million! That's a drop in the bucket."

"Now it is. What about later, when there's ten million, or twenty?"

"It'll never happen."

"It already is happening. I'm not just talking about this country. Do you realize that fool Hopper and his followers have converted half of South America? Have you got any idea what that's doing to our foreign markets? Not only are these workers taking American jobs, but their consumption of American goods has dropped. This country makes all the wrong things to sell to those countries now, because the manufacturers of things they *do* consume are opening factories at the market site to take advantage of their more efficient labor force."

"There's an answer to that, Mr. President; convert the American people."

"That's a really smelly idea, Morner. That's exactly what the opposition party wants me to do. It won't work."

"Why not? American labor's already efficient. We could hold onto our advantage."

"It'd be *too* efficient for our social system. We already have labor problems. What do you think the unions are going to do if we try that? And they're not our worst problem. *You* should know that."

Sybert's mind raced through a maelstrom of economic realities. He had considered these before, but always with the assumption that the situation in which they could arise was theoretical. Now, they could rapidly become fact, not fancy. He knew, for instance, that the housing market and most supporting and subsidiary industries would collapse. Who would buy a house when he could buy a van, or even an ordinary car? All a convert needed was a place to keep his belongings and maybe change clothes once in a while. He didn't need a bed, or any of the other furniture normally associated with a home. Already most converts lived at work, since that was where they spent their time anyway. Those Sybert knew collected little in the way of personal property. That seemed

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to be a habit connected with the old lifestyle.

"All right, Mr. President. I'll concede your point. What I'd like to know now is why you were about to call me. I assume you didn't mean just to bawl me out."

"No. I'm past the stage where I'd get any satisfaction out of that. I really called to tell you I'm directing the Department of Defense to take over the management and operation of Bass Pharmaceutical, as of today."

"You're *what?*"

"You heard me. They should be knocking at the door any minute now."

"You can't do that."

"Yes I can. All it takes is a national emergency, and nobody'd argue we haven't got that."

"Congress would never—"

"Maybe *this* Congress wouldn't. Fortunately there was a really far-sighted bunch in office back during F.D.R.'s second term; you know, right before World War II. Well, none of that legislation has ever been repealed. I've *got* the power, Morner, and I'm kicking you out."

"We'll see about that."

There was a knock at the door. A moment later Bea Kassett popped her head in. Someone pushed her out of the way, and an instant later three of the biggest M.P.'s in the army had carried Morner out, chair and all. The officer who accompanied them advised the president they were in control, then broke the connection. For the duration of the emergency, the research facilities of Bass Pharmaceutical would be devoted to the quest for a reversal process.

* * *

Elliott Bass had stopped shaving and had let his hair grow. He was a hunted man. Six months before the mob had overcome his private guard force and stormed Bass Manor. What they hadn't stolen they burned. Only dumb luck had saved Elliott's life. He'd had his ultralight stored in the attic since leaving college, and there had been just enough flat roof in which to launch it. Never very good at flying it, he nevertheless managed to make it to the edge of town before the fuel gave out, and after that he simply roamed.

But Elliott was still a "Dreamer"; he'd never had the conversion. And dreamers weren't popular these days. Out in the nightmare this world had become, Elliott Bass types were poorly equipped to survive. Elliott was not a fighter, and so he became a runner, snatching sleep where he could, and a mouthful of food wherever he found it. Unlike his competitors for these resources, Elliott could not keep it up. Inevitably, he tired, and the end came the day he lacked the strength to take the next step. A convert, wearing Elliott's shoes, trotted off down the road beside which Elliott's lifeless body now lay still, unaware that he had just killed one of the men who'd made him what he was, and caring only that his feet were covered again.

Rampant unemployment had driven hordes of converts out on the roads. The dreamers who stayed, or tried to stay put, faced foreclosure and eviction as creditors tried to save some small part of their investment. Money, even for those who had some, became worthless, because it was backed only by the sum

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total of the country's industrial worth, and that was now gone. Barter took over as the medium of peaceful commerce.

More and more dreamers, facing both prejudice and actual physical danger because they were vulnerable while asleep, began to convert. The time came when they were a decided minority.

The government had, of course, made attempts to preserve order, but with so many desperate people roaming the countryside there were nowhere near enough reliable troops to do that. So the government became beseiged, and cities began once more to build walls.

There were certain flaws in that plan, not the least of which was that supplies inside these walled redoubts became extremely difficult to obtain. This limited the populations which they could support, and cities began to shrink.

Outside, where there was no longer any law except the law of the mob, little knots of ambitious men began to see that anarchy was not working. There was no way to preserve enough order to grow sufficient food, and if by some miracle that was done, no way to keep the next migrating mob from carrying it off. And so, taking a lesson from the fortified cities, they began to construct keeps, defended by armed men who shared in what they protected. In a decade, the feudal system was the principal form of government in North America.

Elsewhere, in Europe and parts of Asia, the same thing occurred; but there, countries like England which had never abolished it, found themselves politically stable and growing ever more economically powerful for that very reason.

Only one modern industrial power remained on Earth: Japan. Her feudal system had survived the twentith century intact, never far below the surface of her citizens' counsciousness. And these people both respected authority and craved order. There had been no anarchy in Japan, because there had been no rampant unemployment and no panic, and because her borders were secure from mainland hordes. The same disciplined work force that had taken them to the top of world commerce by displaying such efficiency was able to contract and make do when the economic pinch came. The yen lost some value, but never all of it, because the Japanese were always willing to trade manufactured goods for food and raw materials.

Gradually, even the Japanese dreamer became rare. By conversion, they were able to reclaim a major portion of the arable land they had once covered with housing. They turned even more to the sea to feed their population, which like populations everywhere, was shrinking.

That was a benefit of conversion nobody had anticipated, but which was real nevertheless. There were almost no more unplanned pregnancies, because these had been chiefly the product of impulse, and impulse now found few opportunities to rear its head. The migratory habits of much of the world's population also took their toll. Children got in many peoples' ways, so there were fewer of them.

This was not a dark age. Not in the sense that Europe had remembered dark ages. But unlike what had occurred between the fifth and fifteenth century this social upheaval encompassed nine tenths

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of the planet. It was severe, to be sure, but not catastrophic to the race as a whole.

It lasted only a generation.

When it was over, man was streamlined. He had adapted. He evolved social and economic systems to fit the biological reality of conversion. People who had not known the old way regarded the new as the norm. In many cultures conversion was used as a manhood rite. Those who chose not to convert were considered eccentric, but tolerated.

Economies evolved too. Gone was the bond between man and any particular piece of land. Land became a place where food was grown, where a factory or warehouse stood, or where the seat of government reposed. The denizens of walled cities began to destroy their walls, as they had leveled buildings within them when they were no longer needed. As the countryside grew safer between the keeps commerce was revived; and because the idea of nations had not had time to fade and never really died, there was soon no country, speaking a common language, and having common customs which did not revive its central government along pretty much the same lines as before.

The United States was no exception. It was not, and perhaps never again would be, the supreme world power. But it had a large, energetic, and comparatively well educated population. Having adjusted to the same upheaval as many other nations had, it rejoined world commerce and sought the return of prosperity.

Claude Hopper had grown old. His eyesight had deteriorated even more as the decades passed. His red beard was now white, and he walked with a stoop. Today he was enjoying spring, wandering along the shore of the inland sea, barefoot, the legs of his trousers rolled up against the spray. From time to time he stooped to pick up an interesting shell, adding it to the collection in his right hand. As that hand became full he had a choice: stop collecting, or discard the less attractive in favor of the more attractive.

Claude had been in Japan since he was forty-five. He had known, instinctively, that if any human society could survive, this one could; so he had come here.

He had been recognized immediately, of course, and for a while he feared that they might turn him over to one or another of those governments who still sought him, to punish him for his "crime."

They had not done so. Instead, he was given an opportunity to continue his work, and provided with facilities and assistance. Claude had labored for a generation in comparative obscurity, while across the inland sea and across the sea to the east the seeds he had sown in his youth sprouted, grew, and themselves matured.

Claude did not dream any more, in the sense he once had. He missed that, and he was certain others did, too. There was a fascination about the unchained id, that did so much so illogically, and yet all the while was so entertaining to the conscious mind. At first he felt considerable remorse at having taken that away, but as the years passed it became evident that his initial supposition had

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been quite correct; that once having made the adjustment, human beings *were* at an advantage with their perpetual wakefulness. What the new generation had never had it never missed, and by the time he had passed there would be few remaining who would remember what it had been like. That, he thought, might be the greatest blessing man had; death of the old, birth of the new. The race cleansed itself about once a century, and that was good.

It was a mechanism whereby old, inefficient ways could die with old stubborn men who clung to them, along with old enmities and old prejudices. The new humanity was more energetic than the old. The conversion had somehow changed that too. Man's attitude was different. He seemed less aggressive, because he was less territorial. He was more cooperative because he seldom was away from others long enough to discover the difference solitude made. But most of all, he had become more audacious, and this was a blessing Claude valued above all others. With time, at last, to explore his world, man was becoming more and more enamored with the mysteries of what surrounded him.

So, Claude was not surprised to learn that once again, the human race was seriously discussing travel to the stars. That had stopped during what had started to become known as the "troubled time," but it had never been forgotten.

With his new resources of time and boundless energy, the planets were to be opened, and after them the stars. Claude did not know whether or not he would live to see it. Most likely he would not. But when the first ship left for Centauri, or Eridani, or whichever of them man might pick to visit, Claude would have a contribution to make.

He knew, of course, that such a voyage would take a long time. Far longer than the normal lifespan of any man. And, he also knew that no matter how carefully they planned it a multi-generation ship would probably not be workable, because the generation which landed would be ignorant and out of touch with reality. That had to be. Knowledge just could not be passed from one generation to the next with sufficient fidelity to enable that generation to begin the return trip, much less enable its decendants to survive return to an alien earth.

There was one answer, and Claude had it; had had it for almost forty years: deep sleep, one generation, blasting off, reviving to explore, then back to sleep again for the return; safe, natural sleep; the body's own way, with the body's own products. Products that nature, in her wisdom, had placed in the genetic code eons ago, and which Claude had been able to modify to slow the bodily metabolism to a crawl.

Claude's memory carried him back to that day, so long ago, when under the mindless, panicked urging of Elliott Bass the possibility had first occurred to him. It had not taken him long to do it. He already had a good start on the identification of the substances his process involved. He knew very shortly what was needed. And then he'd gone to work, always secretly, to probe their behavior in a normal brain. As he had told Morner, the brain operated electrochemically. That should have been a

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clue to all the researchers who followed him, attempting to crack the same problem. It had not helped them, perhaps because by this time the world had grown too chaotic.

But, he had reasoned, if nature's product could induce sleep, then so could those he would synthesize; he would eliminate an intermediate step and operate a little further down the line. Once again, Claude had tested his result on his own body. Once again, the result had satisfied him. Then, he had closed his notebooks and kept them closed for over twenty years.

He stopped; examined the shells he had collected. Then, in recognition of the futility of this practice, he dropped them all. He always dropped them; he never took them back, never kept them. They had but one real use to him: to provoke thought, to give his body something to do while his mind wandered, so that it wouldn't get in the way.

He started back to the laboratory, perched on the cliff overlooking the sea. He arrived, puffing slightly, eyes watering in the wind, which struck him with greater force now that he was higher above the sea. Inside, he paused briefly, to remove his glasses and wipe the tears from his eyes. Then, he went to his safe.

He had not used the safe in a while, and so it did not open easily for him. But presently its door stood open wide. Claude removed the old notebooks, each carefully patched with tape wherever use had worn them thin. He flipped each open, paging at random, checking carefully to see that they were complete.

Satisfied, he went to his phone and called for a cab to take him to the big government science center in Nagasaki. Then, he waited, cradling the notebooks in the crook of his arm. He would turn them over to others, and others would carry on the work of actual implementation.

But the dream was Hopper's and Hopper's alone. And it was dying. And that was the irony of it, Claude realized. While mysteries remain man dreams of solving them, but with each of man's triumphs a dream must die. Reality is the mortal enemy of dreams.

Claude died a month later. Those who knew him missed him. Many of them were young. Many had no recollection of such a thing as sleep. Many could recall no dreams. Yet many wondered about this old man, and of the place where he had gone, to rest, finally and forever. For man must still sleep, in the end. He always had. Perhaps he always would. Who could say for certain that someday, even that final dream would not die. ■

● Jargon (or "technical terminology") is a marvelous way to convey a lot of information to the knowledgable. It's also a superb way to intimidate the uninitiated. Why do you suppose it was developed?

Kelvin Throop III

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The Alternate View

ALTERNATE UNIVERSES II

John G. Cramer

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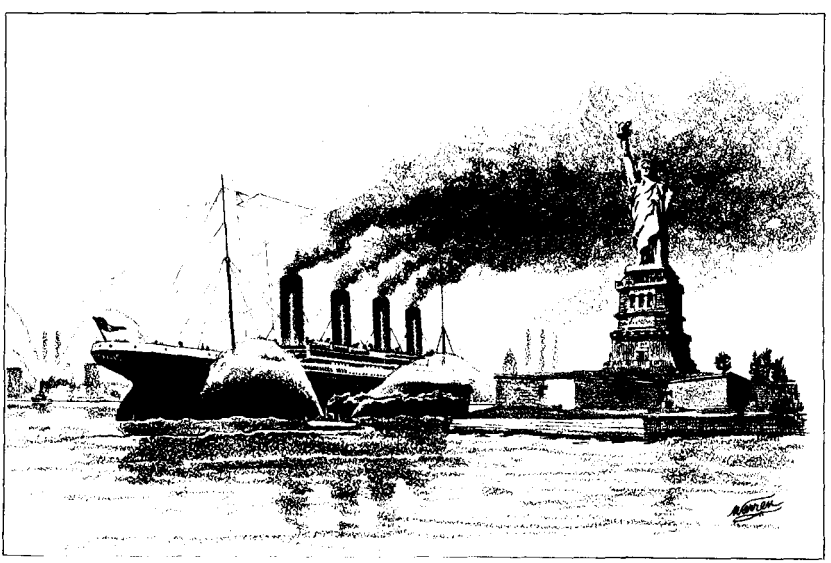
In the fullness of Creation, do **other universes** exist? Are there alternate worlds where history is not the same? Where in 1912 the RMS Titanic sailed into New York harbor intact? Where the American Revolution was lost to Spanish colonies? Where the Renaissance never occurred, and the Middle Ages have never ended? Where Christ and Mohammed were never born, and the Roman Empire never fell? Where there was no large asteroid impact(s) to kill the dinosaurs and end the Cretaceous, and evolved dinosaur descendants are Earth's dominant life form?

My previous Alternate View column (*Analog* September, 1984) described the widely accepted "inflationary scenario" of modern cosmology in which our Universe is just one among very many "bubble universes," all popping out of the general medium of the Big Bang like bubbles forming in a glass of beer. Somewhere perhaps there are many universes more or less like ours, some very similar to and others radically different from the universe we call "home."



This time we examine quite a different basis for the possible existence of alternate universes: **The Everett-Wheeler interpretation of quantum mechanics**. This rival of the orthodox

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"Copenhagen" interpretation of the mathematics of quantum mechanics is the work of the well known theoretical physicist Professor John A. Wheeler and his PhD student Hugh Everett, III, both of whom were at Princeton University when the work was done. Their theory also goes under the name of the "many-worlds" interpretation. To understand the basis for this work we shall look at some of the curious and perverse features of the mathematics of quantum mechanics and the problem of its interpretation.

Quantum mechanics (QM) was invented in the early decades of this century to explain a growing body of new experimental facts that didn't fit with the older ideas of "the way things work" which we now call "classical mechanics." The new QM treated particles (like electrons) as if they were waves and treated waves (like light) as if they were particles. A group of physicists led by Bohr, Heisenberg, Schroedinger and Dirac devised clever mathematical ways of "getting the right answer" with quantum mechanics through a set of mathematical procedures which are now used and trusted by all physicists. The **use** of these procedures is clear and unambiguous. But even now, five decades after their invention, their **meaning** remains controversial. One often hears that "mathematics is the language of science." Quantum mechanics illustrates the point that this language *may lack a proper translation*. Formulating a mathematical theory is not the same as understanding its full meaning. The meaning of the QM mathematics has recently become a subject of intense activity and controversy among physicists (including me), as it had been for decades among philosophers of science.

In the orthodox Copenhagen interpretation, the QM mathematics describes not physical events but rather the *knowledge of an observer* who is watching these events. Equations about mass, energy and momentum are supposedly making predictions about things that happen in the observer's *mind!* This, as one might expect, leads to problems. The Everett-Wheeler approach is an unorthodox alternative which seeks to avoid these problems. Let's consider an example: A radioactive atom decays, spitting out a rapidly moving electron. In the QM picture of this event a wave corresponding to this electron spreads out from the parent atom in all directions, moving out as an ever-widening sphere, like a ring of ripples from a stone thrown into a pond. The electron is equally present in all parts of the wave. It is "buttered out" over the whole wave front. Finally this wave reaches a second atom which is hit by the electron. Immediately the electron wave undergoes a process called **collapse**. This collapse resembles the pricking of a soap bubble, for the wave completely disappears from all of space except the immediate vicinity of the struck atom. There the electron suddenly pops into existence, reappearing as a particle which has just hit the atom. The electron in the form of an expanding wave has vanished.

What if this kind of behavior were also seen in the macroscopic world of everyday experience? Imagine that you stand at a dock on the Manhattan waterfront and toss a beer bottle into the Hud-

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son River. The ripples from the beer bottle spread out across the Atlantic to Southampton, Le Havre, and Lisbon, pass the Straits of Gibraltar and spread across the Mediterranean. Suddenly at the waterfront at Nice a beer bottle jumps out of the water to land on the pebble beach in front of the Carlton Hotel. And simultaneously all the ripples which have been spreading elsewhere around the world abruptly disappear! If such an event happened, the beer bottle in the everyday world would be behaving the way *all* electrons do in the microscopic world. This is what the QM mathematics seems to be telling us. It seems a very strange way to get from one place to another! And it is only one of many examples of the weirdness of quantum behavior.

Most physicists regard this kind of microscopic behavior as normal and refuse to worry about it. They associate collapse with the "knowledge change" occurring when an observer learns an electron's location. Since quantum mechanics works, they use it without being unduly concerned about the bizarre microscopic behavior suggested by the equations. But a few have tried to look more deeply into what quantum mechanics is trying to tell us about the reality behind those useful equations. One such was Albert Einstein, who never accepted quantum mechanics because he found its interpretation unsatisfactory. Another is Hugh Everett III, who found it "unreal that there should be a 'magic' process in which something quite drastic occurred (the collapse of the wave), while at other times systems were assumed to obey perfectly natural continuous laws." Everett did his Ph.D dissertation at Princeton on the problem of finding an alternative interpretation of quantum mechanics which did not involve collapsing waves or observer knowledge. The result was the Everett-Wheeler interpretation of quantum mechanics mentioned above. It embodies a simple but radical idea.

According to Everett's description of the electron event, the wave never collapses. Instead, at every occasion where the electron might strike one atom or another, *the universe splits!* We have one universe where the electron hits atom A, another where it hits atom B, and so on for all of its possible outcomes. Similarly, if a light photon might be transmitted or reflected, if a radioactive atom might decay or not, the universe fragments and we get one new universe for each and every possible outcome. The universe, then, is like a tree, branching and re-branching into a myriad of new sub-universes with each passing picosecond. And each of these new Everett-Wheeler (E-W) universes has a slightly different sub-atomic "history." Since our present consciousness happens to have followed one particular path through the diverse branches of this Universe-Tree, we never perceive the splitting but instead interpret the resolution of the myraid of possiblities into a particular outcome as an abrupt "collapse."

Microscopic events, of course, lead to consequences on a larger scale. Somewhere there should be E-W universes in which every physically possible event that *could* occur *has* occurred! There should be universes where Man never evolved, where Carthage defeated Rome, where Hitler won, where your

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present location is a smoking radioactive ruin of World War III. Even as you read this sentence the universe should be fragmenting into a number of branches too large to count.

The Everett-Wheeler interpretation has not been received with overwhelming enthusiasm by most physicists. It is regarded as multiplying hypotheses beyond necessity, as William of Occam put it. It is not widely accepted, but it is much discussed. Many physicists consider it unlikely that nature would behave in such a schizophrenic way. Many find it harder to swallow the multi-universe idea than to accept the collapse of the waves. But perhaps the most serious criticism of the Everett-Wheeler interpretation is that its predictions for the outcome of experiments do not differ from those of the orthodox Copenhagen interpretation. Therefore it is an untestable theory. Scientific theories are normally worth considering only when experimental tests might prove them wrong. Otherwise a theory is metaphysics, philosophy, or myth, but it is not subject to the scientific method and therefore it is not science.

But let's lay aside these worries, assume that there really are alternate Everett-Wheeler worlds somewhere, and ask some questions:

Q: Could E-W universes be the same as "bubble universes"? No. The bubble universes should have separated themselves from the medium of the Big Bang in the first picosecond, and thereafter should remain completely unconnected (unless they happen to bump together). They can't be the same as E-W universes.

Q: How might one manage to go from one E-W universe to another? I can only speculate. QM allows physical systems to "leak" from one state to another (example: the alpha-particle decay of uranium-238), so perhaps one could "leak" into an alternate universe, particularly one which was locally very similar to ours. Or given a time machine (a big "given") one might travel back in time to a split-point, then travel forward along another E-W branch to an alternate version of the present.

Q: E-W universes split *only* going from past to future; doesn't this time asymmetry contradict an important principle of microphysics? Yes, it does. But the Everett-Wheeler interpretation can be generalized to a more time-symmetric form by including a "healing" of splits whenever two E-W universes accidentally become completely identical. This is a fascinating idea in its own right. It leads me to assert the **Historical Uncertainty Principle:** *All versions of history which are physically possible and consistent with the present state of our world are equally true and have equally led to the present along various E-W branch universes which healed together to make the present.* There is no "right" account of the recent or distant past; all consistent versions are equally correct. (Just think of the implications of that for historians and lawyers!)

Q: But do you really *believe* any of this? The "bubble universes" I find quite acceptable. But for me the Everett-Wheeler interpretation lacks the "feel" of validity and itself raises too many problems. To be fair though, I am not really an unbiased critic because I have my own published unorthodox interpre-

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tation of QM mathematics. But that I will save for another AV column in some future universe. ■

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ON GAMING

(continued from page 69)

ever will gain *you* the most credit and recognition. But assigning the job to another officer may be the best strategy: if he fails or botches the job, you can shift blame to him. If he succeeds, you, as captain in charge of the operation, can still take credit!

The other major element in the series is the board game, *Starship Combat Simulator*, which is based on the ships and the combat situations in *Star Trek II: The Wrath of Khan* and in *Star Trek III: In Search of Spock*.

Unlike the rpg, the board game has a more traditional strategy design, thus giving you a chance to go toe-to-toe with the Klingons.

The board game includes: a 22-by-34-inch hexagon map of a typical section of deep space; 78 large, hex-shaped cardboard counters representing planets and starships; 112 smaller cardboard counters that are placed on displays to keep track of ship functions, such as power, weapons, shields, sensors, etc.; a 16-page booklet with displays for engineering, weapons, damage control, etc.; and five rule books.

To get started playing right away, all you need do is read the 8-page *Book 1: Basic Starship Tactics*, and use the information in the 16-page *Book 3: Starship Data and Combat Charts*. For those who master the basic game, there are 24 more pages of instructions in *Book 2: Advanced Rules*. There are also several scenarios provided—from short introductory fights for beginners to Star Fleet Academy's special test for cadets. This latter scenario was shown in the *Star Trek II* movie. As commander of a single *Enterprise*-class heavy cruiser, you are not expected to win the contest against several battle groups of Klingon ships. Instead, the scenario serves as a test of character.

FASA's *Star Trek* series is truly impressive. The high quality of presentation and writing makes these books and games of value to anyone interested in the *Star Trek* universe. ■

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"SLAN LIBH"

Michael F. Flynn

One of the peculiarities
of human beings is
that some of them feel obligations
to other generations—and
that doesn't necessarily mean "descendants."

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"A time machine *needs* blinking lights!" declared Kevin O Malley. His two graduate assistants laughed. Kevin could see the undercurrent of excitement in their eyes: every test had worked. A Time Machine! A real, honest-to-God Time Machine! He finished off the rest of his drink and explained.

"All the time machines I've ever read about, they all had flashing lights. It wouldn't be *right* to build one that just sits there and does nothing."

"Nothing?" asked Doris. "Sure. All it does is travel in time."

They all laughed again, feeling giddy.

"Where should we go first?" asked Hank. "Rome? Athens?"

"No, Kumbi Saleh!" said Doris.

Kevin swiveled in his chair and stared at the machine in the corner of the lab. The finish was rough, the lines far from sleek; but it was beautiful. "Let's be careful," he told them. "We'll wait for the last computer run. Wouldn't want to change history by stepping on some prehistoric ant."

"When will we know? About the space-time curvature, I mean," said Doris.

Kevin looked at his watch. "Well, it's Friday. If the Center doesn't deliver it tonight, they're supposed to get it to me first thing in the morning. Why don't you two go home now. Party's over. I'll stay here and wait a while. We can decide on Monday what we want to do."

"Sure, Doc," said Hank. "Whatever you say." The two gathered their things. Kevin poured himself another drink. He liked Bushmills, straight up.

"See you Monday," called Doris. Kevin lifted his glass in salute. After they had gone, he sat for a while sipping his whiskey, not taking his eyes off the machine. The drinking had made him giddy. He thought about it long and hard, then grinned. "Why not?" he asked the room.

He rummaged through the workbench until he found all the right tools. The parts bin contained a dozen or so lights. He stuffed them into the pockets of his lab coat along with some wire and other components. Walking back past his desk, he paused to finish his drink. He drank a silent toast to his grandfather: *I owe it all to you, Gramp.*

He recalled the flash of insight he'd had as a teenager. His grandfather had been telling him a story about his own immigrant father. When he finished, Gramp had leaned back in his padded chair and shook his head. "A pity it is, Kevin, that you never knew him."

The phrase had stayed with him. The idea of meeting his own great-grandfather intrigued him. Then, a few days later, he had read a book about the new physics. He was amazed at the notion of tachyons moving backward in time and black holes wormholing through space. His grandfather's words had come back to him and suddenly he had *known* that it was possible to travel in time.

He laid the tools and parts out on the floor in front of the machine. It had been twenty years converting the teenager's insight into the physicist's accomplishment. He grinned again, thinking what Hank and Doris would say when they came in on Monday. Then he very carefully began installing a row of blinking lights in an empty panel.

Kevin slept late the next day. School

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was not in session; the lab work was done. There was no reason to get out of bed. His head ached from the drinking.

A noise from the living room startled him. Then he realized it was the sound of mail falling into the chute. "That late already?" he wondered and felt guilty about his laziness. "Ah, well. If anyone's earned a vacation, I have."

He shrugged into his robe and wandered into the living room. The mail was in a clutter on the rug. Absently, he thumbed through the envelopes and headed for the kitchen. Mrs. Gonchar, his once-a-week cleaning woman, was forever asking him why he stayed unmarried. It was sexist to think so, but on mornings like this he wondered the same. He hated cooking, especially breakfast. But his work always took up too much time. Maybe now that the Big Project was nearly over . . .

His thoughts paused as a letterhead caught his eye. University of Massachusetts. His old friend, Tom LaBret was teaching there in the history department. He sat at the kitchen table and opened the envelope. Inside, he found a letter and a sheaf of photocopies.

Dear Kevin,

I remember on your last visit you asked me quite a few questions about the Irish Famine. Well, a lady in Boston died and left the History Department a bundle of old letters. We've been sorting through them and are not done yet (the old gal kept 'em in shoeboxes!) but I did see some that I thought would interest you (you'll see why) and am sending you copies.

These were letters written by a young English coastguardsman stationed in the west of Ireland during the Famine. He wrote all about what he saw to his folks back home.

How are things in Sunny California? Don't you miss Culture and Breeding out there? Still working on that Nobel Prize?

Tom

Kevin chuckled as he unfolded the photocopies. There were three letters, arranged chonologically. He began to read.

. . . Inasmuch as the Government refuses to purchase large quantities of food in competition with private enterprise (or even to suspend exports of food from Ireland), we are thrown back on Commissariat resources. I have reports that the oat-meal in Cork City is so old as to be unfit for human consumption. Here at Drumgellach, I dole out as little as I can. I much fear that the stores I do have will fail to last the winter. . . .

The declaration of the Poor Law Commissioner that he will not participate in any relief given outside the workhouses seems, as I understand it, to throw on me a mass of detail worthy of much thought and apprehension. The only hopeful sign locally is the situation of a cottier named Conner O Malley. He refused his allotment today, saying that a relative from America had brought food. Otherwise, we all await hopefully the shipments of Indian corn which the Americans are said to be sending. . . .

Never was anything so calumniated as our Indian corn! The millers have damped the meal to increase the weight (and their prices), making it sour and unfit for human food. Were

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it not for Conner O Malley's American cousin, the distress would be far more severe. However, I really fail to see from where the fellow has obtained so much food. There are no satisfactory harbours on this coast to hold any substantial ship. . . .

Kevin O Malley was very thoughtful when he finished. Conner O Malley of Drumgellach, was it? He remembered the round of intensive geneology he had engaged in after his grandfather's death. Called upon to read the Lesson at the services, he had come to the passage: "Man's days are like grass. . . . The wind sweeps over him and he is gone and his place knows him no more." Those words had moved him profoundly.

The urge to provide a remembrance had led him into libraries and archives, from his father and grandfather back to Ireland. In the end, he had had a name. One last name before the line of his family vanished into the unremembered past: Conner O Malley of Drumgellach, County Mayo. His great-great-grandfather.

How like Tom to recall our talks and make the connection with the names.

He was still thinking about the letters an hour later when the telephone rang. He picked up the receiver. "O Malley here," he said.

"Doc? This is Jim at the Computer Center. We got your printouts for you. You want I should send 'em over?"

His pulse sounded loud in his ears. "Yes. One thing first, though, if you would. Is the curvature positive or negative?"

There was a rustle of machine sheets at the other end. "Is that the kappa? Hmmm. Here it is . . . Negative, Doc."

Kevin smiled. "Thank you, Jim. I was hoping you'd say that."

"Sure thing, Doc. Anything else? Still not talking?"

"No, but we'll be writing it up soon."

"OK, be that way. I'll run the full report over right away."

"Goodbye."

He leaned back in his chair. Negative curvature. The past is changeable but self-correcting. Easy to change small things; harder to change big ones. He felt a surge of excitement. The old half-forgotten enthusiasm for geneology and the new one for physics combined. The strange American who came from nowhere with a seemingly inexhaustible supply of food. Who else could it have been?

He wondered briefly what would happen if he did *not* use the machine to feed his ancestors. Would his great-great-grandfather die? Survive anyway? How small an event is a human life? Some things you did not experiment with.

He rose from the chair and stretched. He wondered how much food there was in the pantry. There was no question of blunting the Famine itself: it was too big an event. How did the expression go? A million dead and a million fled. He shivered. But one small part of it, that much I can help.

The time machine was a marvel, it was. It made no noise. It neither rattled nor shook; but how the lights flashed! Kevin was suddenly glad he had installed them. They made him feel he was really traveling. Then he sensed

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motion. He turned in his seat. Sure enough, he felt like he was moving forward no matter which way he faced. Travelling at right angles to everything.

The timer clicked off and the lights stopped flashing. So fast? He turned on the outside viewscreen, half expecting to see his own lab after all.

A wind-whipped barren landscape greeted his eyes. The machine sat partway up the side of a hill. There was a dirt track at the bottom and below that, slate-colored waters crashed on a rocky shore. He rotated the camera. "Too exposed," he thought.

There was a grove of trees a little distance off. He set the controls once more. This time the trip was so brief he noticed nothing. He checked the viewer again. Trees surrounded him on all sides. He grunted in satisfaction. Since the machine grew into ordinary time from a dimensionless singularity, it had simply pushed all matter, trees included, out of its way.

Outside, he set the lock. The machine sank several inches into the ground as the weakened field allowed some of the hawkingmass to be converted into weight. Satisfied that no one could enter the machine or move it, he shouldered his rucksack of food and made his way down to the road. He looked back once and could see no sign of the machine.

The winds were blowing the cold Atlantic spray along the shores of Burishoole. Kevin checked directions against the rising sun and set off toward Drumgellach. It was the bitter December of 1845 and the newly harvested potato crop was already falling to the blight. September, in Cork, that had been the first sign. Now the peasants were beginning to dig up the potatoes kept in the earth pits. These were normally saved through the winter. Eaten too soon, the spring would be a desperate time.

And Kevin O Malley alone of those awake in Ireland that morning knew that this year's harvest was the best there would be for half a decade.

He saw a figure walking toward him and waved. The other man hesitated a moment then walked over. At first Kevin thought it was an old man, his hair bleached white and his skin a gleaming leather. Looking closer, he saw that the man could not be much over fifty. He carried a gnarled walking stick, but he carried it more like a club than a support.

"Hello," said Kevin. "Could you tell me how to find Conner O Malley?"

The man squinted and tapped his ear. *"Dia's Máire dhuit. An bhfuil Sacsanach?"*

All his careful planning . . . He had forgotten how little English had been known in the West of Ireland. He stammered a little. "Ahh . . . Conner O Malley?" He pointed in several directions and shrugged. A pantomime.

The Irishman grinned and nodded. *"Conchobar O Maille! Tá se sa bhaile."* He pointed down the road. *"Tá a thighsean thall ansan ar an gcnoc."*

"Oh. Well. Thank you."

The man laughed again. Kevin watched him until he had walked out of sight. "Well, Kevin, me boy," he said aloud. "Do we go home for a crash course in Gaelic, or do we hope that someone down the road speaks English?" It would be easy to learn the language. He could take as long as he

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wanted and still return to the same point in time.

He could feel the air warming up. It was much too fine a day for turning back.

Farther down the road he saw a farmhouse atop a hill, and wondered if the man had been pointing at it. Seeing nothing to be lost, and hoping at least for better directions, he climbed the path.

When he reached the top, he was appalled at how small the whitewashed, thatch-roofed cottage was. No window broke the monotony of the wall. The wooden door was ill-fitted to its frame. He paused for a moment before knocking, wondering if that were the custom in this time and place. He shrugged and knocked.

No answer.

He waited a while, feeling foolish. "I've come so far," he thought, "and no one's home." He peered through the crack between the door and frame. Inside was one large room. Empty. An iron pot hung over a fire in the kitchen wall. He could see a rude table and some stools. A shelf at hip level ran along one wall.

He walked to the back of the house, not knowing what else to do. A few simple farm instruments were racked against the wall. He took one down and studied it. "Maybe I should bring Tom with me," he mused. "This is more in his line. What fool errand of mercy brought me here?"

A voice behind him broke into his reverie. "Do ye see anything ye might be wantin?" It was a lilting brogue, but it was English. Kevin turned to face his accuser.

A young man, hardly more than a boy, stood there squinting suspiciously. He was slight of build, with a sandy colored head of hair. He held a spade and a covered wooden bucket in his hands.

"Ah, no," said Kevin, embarrassed. "I was seeking the house of Conner O Malley."

"Well, ye've found it; but not Himself. He's gone walkin. Ye've passed him on the road, if ye've come east."

The old man. Kevin described his encounter and the youngster laughed. "Tis a fine one he pulled on you, I'm thinkin'."

Right, thought Kevin. He's probably sitting out there on some boulder, laughing his fool gut out.

The lad extended his hand. "Tis Sean O Malley my name is. His eldest."

Kevin felt a shiver. *Old John. Gramp's father, who died before I was born.* He heard his grandfather's voice: *A pity that you never knew him.* He remembered that he had this man's death certificate, gathering dust in his geneology scrapbook. He was dead on the railroad a long time ago, and here he was alive.

"I'm Kevin O Malley," he said. "From America. I've come to see the old family places."

Sean leaned the spade against the wall. "Welcome to ye," he said, picking the bucket up once more. They walked together to the front of the cottage. "Though I fear ye've picked a poor time to see this old sod."

Inside, it was dark and smokey. There was a smell of peat in the air. Sean went to the fire. He opened the bucket and

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began dropping potatoes in the boiling water, checking each one as he did. After about three or four spuds had been taken, Sean groaned and sat with his head in his hands.

Kevin looked in the bucket. The remaining potatoes were turning black. He recalled that the blight was an airborne fungus that germinated in water. The warm, wet West of Ireland, with its soft breezes, was a perfect nursery. Once out of the ground, the roots were attacked savagely.

Sean looked up bleakly. "Sometimes they're still good when ye dig 'em up. We never take 'em if they've got the fuzz on the leaves. Sometimes it helps to get 'em in the water fast. Sometimes there's enough to eat."

Kevin took off his knapsack and laid it on the table. The packages inside clunked and rustled. "I've some food with me," he said.

When the sun was going down, the women returned to the cottage from their domestic work at the squire's estate. When they smelled the carrots and cabbages, when they smelled real meat cooking, they dropped their bundles in the path and ran to the doorway.

Sean introduced his mother, Máire ni Larrisey, and his sisters, Brigit and Caitlín. Brigit held an infant second son, Tomás. Kevin was struck by Máire's beauty and guessed that she was closer to his own age than to Conner's. Séan explained who he was and what he had brought. They gathered around him, hugging him and bubbling their thanks.

Abruptly there was a chill in the room. Conner stood in the doorway. He carried a small sack in his fist. He cast a disapproving look around the room, lingering on Kevin with obvious disdain. He asked Séan a question in Gaelic. The lad answered. Conner broke him off with a wave of the hand. He looked at Kevin unbelieving, his hands on his hips. His gaze locked with Kevin's. Without moving, he shot a sentence at Séan.

Kevin felt like a bird confronting a snake. There was a power in the old man. From far away, he heard a tentative voice.

"Me father says we have no kin in America."

Kevin did not know what he had expected, but it was not this. How could the old man *know*? "Tell him that I am a very distant cousin." He waited for the chain of translations to work its way to Conner and back.

"Da says no O Malley has ever left Burishoole. Owen O Malley of Claggen is seanachaigh and can recite the four generations of the O Malleys." Conner added something more and Séan continued, ". . . and even the dead still live here."

All during this exchange, Kevin's eyes remained locked with Conner's. Several thoughts tumbled in his head. One said: The seanachaigh is still alive! What a treasure mine of family history he would be. Another: The old man will throw me out. I've failed. And a third: At least they will have eaten for today.

Conner turned his back and it was like a wire had been cut. Kevin realized he had been sweating. He watched Conner walk to the fire and stare into the stewpot, grim-lipped. He grabbed the iron poker and Kevin knew he meant to tip

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the stew into the ashes. Máire and the girls were frightened.

"No!" he cried. Conner jerked around and spat out something angry.

"No one but me father feeds his family," Séan translated, his voice a mixture of pride and hunger. Conner brandished the sack he carried. It was a handout of grain from the English storehouse in the village, but it was grain *he* had gotten.

"Tell him he will," Kevin said desperately. "Ahhh . . . The food is not a gift! I expect him to pay for it!"

Incredibly, the father relaxed when he heard this. Honor had been satisfied.

What a stiff-necked, unbendable son-of-a-bitch, thought Kevin.

At supper later with the family, he discovered that he had forgotten his childhood grace prayers. He mumbled indistinctly, hoping the others would not notice or would take it to be English. But, from the corner of his eye, he caught the gleam of Conner O Malley's contempt.

Not until he was relaxed in his own study with a mug of steaming coffee could he review his trip without shaking. The old man had been surly, but Máirre had been cheerful and full of talk. She could not stop thanking Kevin, to his own embarrassment and Conner's slow rage. He thought of how she had looked at him, her smile framed by dark, flowing hair. The stereotypic Irish beauty. God, how could anyone smile in those circumstances? When he had helped her clean the table, their hands had touched. He looked at his hand and shivered: a combination of anticipation, of fear, of self-loathing.

That was no direction for his thoughts to take. He drank the rest of his coffee. It had turned cool and bitter. He set the cup down and rubbed his temples. He had to plan the next trip. He knew he should have done more thorough research. The matter of the Gaelic disturbed him. What else had he forgotten? The past was a world, with living people, not a stage backdrop.

Typhus. God! He sat bolt upright. There would be typhus as well as starvation. It would not be enough to bring food. He would need tetracycline and DDT.

He tried to remember when the fever would break out. Was it the winter of '45 or the following spring? It was foolish to wonder. Who had ever chronicled the course of events in far-off Drumgellach? It would be better to wait until the disease showed itself. DDT could easily select for resistant strains of body lice.

Well, he could spend several months in his own near past learning Gaelic, rereading *The Great Hunger*, and buying food. The Depression would be good for the latter: prices were low, if he could find enough old money. He checked the clock. It was still Saturday morning. The mail had come just two hours ago.

Conner seemed inclined to slam the door in Kevin's face. He ignored the outstretched hand until it dropped. Then he grunted sourly and stood aside. Kevin took that as an invitation and stepped into the cottage. Séan and Caitlín were there and they waved to him. Conner had gone to the turf fire. He stood with his back to the room and

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to Kevin. In Gaelic, he said, "So you've come back, have you, Saxon?"

Kevin answered before Séan could translate. "And I'll keep coming back as long as I can help."

Conner spun around and Kevin grinned at his look of astonishment. The old man's face darkened. "So you've been playing me for the fool, eh?" He balled his fist and cocked it.

"Easy, man. I've studied the language since my last visit."

Conner snorted. "And learned it in two weeks?" He lowered his fist and scowled. "Your accent is terrible. You must have learned it from a Munsterman."

Kevin smiled and laid his backpack on the table. "I've brought more food," he said. Séan and Caitlín whooped with delight and fell on the packages.

Conner rubbed his nose. "And your price is the same? To write down Owen's tales of the O Malleys?" Kevin nodded and Conner shook his head in wonderment.

Kevin looked around the room. "Where is Máire?"

Conner looked at him. "Not here," he answered. Then he added, "I'll not play Ailill to your Fergus." Kevin frowned, not understanding. Conner only shrugged and said, "Séan will take you to Claggen."

They bounced along the rutted road to Owen's place. Séan held the reins of the pony cart, but allowed the horse to make all the decisions. "Owen's lands are still good; but we don't know why. He feeds all Claggen from his plots."

Kevin answered absently. "The fungus was brought over from America. We had it there . . . two years back. A German ship brought it to Holland and it spread from there. It's patchy now, good fields and blighted fields side by side, but it's spreading. A fifth of the crop was lost this year. Next year will be . . . could be much worse."

"How do you know all that?"

"Oh. It's talked about," he said vaguely. "I don't suppose it's a secret. Maybe it wasn't the German ship that brought it, but that's the story I heard."

"And those other people, the Americans and the Hollanders, have they gone hungry as well?"

"And the English, too. They have it there. They also own their own crops. No landlord comes to ship it to another country."

"Father says you're wicked."

Kevin looked over, startled by the abrupt change of subject.

"Now, why would he say that?"

"He says you're generous without caring."

"Without . . . Haven't I brought you food?"

"You have. Father says it's for your own reasons."

Kevin was silent. He could not deny it. What was it? Some idea of becoming the Great Benefactor? His own pride? Fulfillment of those old letters? There was no predestination forcing him. Who had ever said he must justify himself to Conner?

"He says you don't really know how we live. He says you should come at planting time if you want to . . ."

"He says! He says!" exploded Kevin. "Who is Conner O Malley, God?"

Séan turned to him. "Not God. My

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father. There is no God in Ireland these days."

For months, Kevin appeared regularly at the O Malley cottage. Each time he brought food. It was fresh food and varied and no one knew where he had gotten it. He was welcomed heartily by Séan, Máire and the others. Especially by Máire. Even the neighbors opened their doors to him, for the fortune of Conner O Malley was theirs as well and the food was widely shared.

The one exception was Conner himself. He rarely spoke to Kevin and, when he did, it was to give him an order or to cut him down. In the spring (early Sunday morning, back home), Conner shoved him into the fields with the others, to dig the lazy beds for the potatoes.

Kevin complied, although he knew the crop was doomed. He scratched and turned the earth under the damp sun.

Resting, he leaned on his spade. Conner passed by and suddenly the spade gave way, kicked from beneath him. Kevin leapt to his feet, angry, gripping the spade like a club. Conner turned to him, grinning fiercely, ready to fight. He looked at Kevin and at the spade. Conner laughed. "Do not show your teeth if you cannot bite," he said and turned away.

Kevin flushed, feeling Séan's eyes on him. The old cliche of time travel, killing your own ancestor, sprang to his mind. He could do it. There was no penalty in the physics. He shifted his grip on the spade.

Séan turned back to his work. Brigit and Caitlín, farther up the hillside, had not even noticed anything. Conner ignored him. Kevin threw down the spade and stalked off. *Don't look back*, he thought. *If you look back, it's a weakness.*

He looked back.

The O Malleys were paying him not the slightest attention.

With the anger still boiling within him, he trudged down to the cottage. Conner could go to hell for all he cared. He probably would. Kevin decided he had made his last visit. Owen O Malley and the parish church had yielded their last bit of family history. There was no longer a reason to return.

Except Máire and the others. They had never been anything less than kind.

He paused when he came to the cottage. Máire was there, washing clothes in a big tub behind the house. Conner was in the potato fields and Máire was here. Suddenly he was afraid, more than he had ever been of Conner. He saw where the water had splashed Máire's blouse, making it cling to her body.

If you stop, he told himself, *you may not go. And wouldn't* that *be a vengence on Conner?* He began to hurry past, but Máire looked up and saw him.

"Kevin!" she said and ran over, wiping her hands on her apron. She took his hand in both of hers. Kevin looked down. Her hands were rough, work-hardened but cared for. He could hear his own pulse in his ears.

She looked in his eyes. "You are not leaving us again?"

He shook his head. "Only for a little while."

"Is it Conner? I know it is. Don't give way to him. It's what he hates most. He's pushing you and pushing you to see how far you will be pushed. It's the way of it among the men here."

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They had started around the side of the cottage. They were still holding hands. *Let go,* he told himself. His hand was paralyzed. They stopped by the front door. It was open and Kevin could see inside, see the straw bedding on the floor.

She looked him in the eyes again. "We need you here. I need you here. Conner is a good man, but he does not understand what is happening. He is angry and afraid. I was too, until you came. You've done so much for us. I would do anything to repay you."

Anything? Kevin watched with horror as his hand came alive. It moved by itself to Máire's waist. He thought she sighed. He looked in her eyes. What did he want to see there? Hot lust? He pulled his hand away even as it moved up her side. God!

Máire did not move. She stood as if nothing had happened. Had anything? Holding hands, a casual touch. Nothing more, not even a kiss. Magnified in his mind by his own wild imaginings.

He cast about for something to say. Something neutral. He recalled a remark of Conner's. "Máire, tell me. A couple of . . . months ago, Conner told me that he'd not be Ailill to my Fergus. What did he mean by that?"

Máire looked puzzled, then startled, then she laughed. "He said that? Does he think I am Maeve then?" Her laughter was like small bells. Suddenly she stopped and looked at Kevin, her eyes wide. She touched his hand again. "Or do *you* think I am Maeve?"

Kevin shrugged helplessly.

"Don't you know the *Tain bo Cuailage*?" she asked. Kevin shook his head. "Tis an old story from pagan times, about Cuchulain and Conner mac Nessa. The storyteller used to recite it under the hedges before the Saxons let us have schools again." She giggled. "He even told us the parts the priest didn't like. When you go . . . wherever you go, read the *Tain*. You'll know the part. God be with you."

It was a dismissal. He turned to go. When he reached the path going down the hill, she called to him. "Be careful, Kevin. My brother's wife thinks you come from the Devil."

"And does Conner think so, too?"

"*From* the Devil? He does not. But, he wishes you would go *to* him."

Somehow that struck Kevin as funny and he threw back his head, laughing. He was still laughing when he reached the spot near where he had hidden the time machine. He sat down on a boulder and thought. He picked up a large rock and tossed it idly from hand to hand.

After a while, he sighed and walked up into the trees. He looked automatically for any sign that someone had been there. Finding none, he pressed the combination buttons in the proper sequence and the hatch opened. He climbed inside and sat on the padded seat. He flipped the switch that activated the blinking lights. He watched them for a while: the meaningless decoration that he had added in a moment of whimsy. Then he lifted the rock in his hand and very methodically smashed each one.

Kevin was only vaguely aware of Mrs. Gonchar. He had endured, without hearing, her weekly lecture, as she went about her Monday morning cleaning duties: A man with no family of his own should be out trying to start one, not

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spending his time cooped up in a laboratory. It wasn't healthy. He looked so haggard each time he came back. Older, somehow.

He did not try to explain that the few minutes he spent in the lab were often weeks in the past. She would not understand. His obsession weighed on him. Doris and Hank would be here soon; time was running out.

He decided he did not much like his ancestor. He considered building a smaller machine, one with an automatic return, so he could deliver food without going himself. But he gave it up, telling himself he could not slip it into the cottage without frightening Máire. The real reason, he knew, was that Conner would despise such cowardice.

Mrs. Gonchar brought him the morning mail, shaking him from his reverie. He noticed another letter from Tom in the pile. More of the coastguardsman's letters? He opened the envelope eagerly.

Dear Kevin,

Sorry to disappoint you. I missed this letter the last time. It's the only other one that would interest you. That must be some family history you're writing. Giving up physics to compete with me? I'll write later. Ronnie says to tell you she said hello.

Tom

. . . I suppose tradgedy really was inevitable. I had hoped that the summer would see us out of our problems. This has been the most anxious and unsatisfactory task I have ever undertook. Were it not for O Malley's American cousin our situation should have been far worse. He was a great comfort to those struck by the typhus. Many we had given up for lost miraculously recovered, though not, alas, all. His generosity touched all of us, and everyone in the village visits his grave regularly . . .

The paper blurred. It couldn't be! Kevin felt sick. He read the letter again, but the words were the same. He slumped weakly. That settled it. He could not go back now. Not even for Máire or little Tomás. Conner could not ask that of him.

Conner? He was not doing this for Conner. The old man would be more than happy if he never came back at all. He remembered what he had read in the Irish epic, the *Tain, The Cattle Raid of Cooley.* Ailill and Maeve, the king and queen of Connaught, had gone to war with Ulster. Their guide, an Ulster exile named Fergus, had slept with Maeve; and Ailill had tolerated it in order to keep his help.

"I'll not play Ailill to your Fergus," Conner had said. Well, damn him if he thinks that! He can only push me so far. The past may not be fluid, but it's not carved in stone, either. My own equations proved that. I'm forewarned. There needn't be a grave at all.

Mrs. Gonchar came in and saw him. She gasped. "Professor! What is wrong? You look ill!"

"Perhaps I am."

She nodded smugly. "I knew it. The Good Lord Above knows how you care for yourself when I'm not about. You need a family and a wife to look after you."

Kevin was silent a long time. Then he got up and walked to the door. I'm going to see Doctor Bench," he said.

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Mrs. Gonchar looked concerned. "You *are* ill."

"I need tetracycline. A lot of it. And DDT, too." There would be plenty of that available a few years in the past, before the ban.

"I've said it for years now, Professor. You get yourself a family."

Kevin stopped at the door and turned. "I have a family," he said.

He had locked and hidden the machine and was walking down the road toward O Malley's house when Conner himself saw him. Kevin thought it was about the same spot he had first seen the man, so long ago. This time Conner was riding a horse and leading another. They were fine horses that Kevin had never seen before. He was sure they had been stolen.

"You," said Conner.

"Your welcome overwhelms me," Kevin snapped back. Conner's face did not change, but Kevin thought he saw something in his eye.

Conner tossed him the reins of the lead horse. "I was riding to get my wife's brother, but you will do."

"For what?" asked Kevin even as he grabbed the horse's neck to swing up. He had never ridden before and wondered if he would fall; but the horse was well used to a rider.

Conner explained as they rode into the hills toward Molyranhee. There was an evicted family there. Another man had offered the landlord a higher rent for the land, so the family had been thrown out. The father has resisted, of course. It was death to be Irish and landless in Ireland. In the end, troops had been called in and the roof of the cottage had been torn down.

"They say," finished Conner, "that one company of soldiers nearly mutinied over the duty. They hate it: it's not soldierly work. I suppose there are some good men even among the Saxons."

"But why are *we* going there?" There were so many evicted families dying, what did one more matter?

Conner looked at him. "Because they are O Malleys."

When they reached the place, Conner called out. There was no answer. They dismounted and walked to the broken wall where the doorway had once been. A piece of cloth fluttered there, the only door the hovel had ever known. Kevin looked around. Until now, he had thought that Conner was poor.

They entered the ruin. There were several figures huddled there under a flaxen blanket. Kevin could see their legs sticking out. At first they all seemed dead. Then one moaned. The blanket shifted and Kevin could see there were six of them, all naked. Four were children. The mother lay stiff and motionless. The children were glassy-eyed. The father fixed his gaze on Conner and Kevin. He raved like a lunatic, but had not even the strength to roll away his wife's dead body. The stench was terrible. Kevin nearly gagged. He saw the heavy rash on their limbs and trunks: typhus.

Conner saw it, too. Kevin turned to see the other backing away. "It's the Fever," said Conner, crossing himself.

He went after Conner and grabbed his arm.

"Let loose!" cried Conner. "We cannot help Donal now!"

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Kevin knocked him down. "We can! Make a fire. Over there, if you're afraid to come closer. Find a pan and boil some water. Boil it! Then call me."

Conner got up and glared at him; but he went to do what Kevin had said.

Behind the cottage, Kevin found a spade. He picked a spot and began digging. He had a grave half-dug when Conner reappeared. Worldlessly, Conner took the spade from his hands. Kevin climbed from the hole and returned to the front while Conner finished digging. He wrapped his hand in his shirt and took the pan from the fire. Then he went inside and carried the children out one by one. The man resisted being dragged, but he was not strong enough to matter.

Kevin took the blankets from the two horses. From his pack, he took a can of insecticide dust: a combination of DDT, malathion and lindane that Doctor Bench had recommended. He dusted the blankets thoroughly before wrapping them around the children.

He took the medicine from his pocket. He opened the bottle, fumbling a bit with the childproof cap. Doxycycline in 50 mg. tablets. Doctor Bench had said that a single 100 mg. dose of this particular tetracycline would cure most adults, even in field conditions. He gave the man two tablets.

"Swallow them," he said. The pan was cool enough to handle now and he gave Donal some water to wash the pills down. Then he turned to the children. It was more difficult, but he gave them the medicine as well, one tablet each.

As he finished, Conner's shadow fell across him. He looked up. "Let's bury the woman," he said. Conner backed away and Kevin lost patience. "You fool! It's the lice, they carry it. When you scratch where they bite, it gets into your blood. But the fever itself drives the lice away. There aren't any left on these people, certainly not on the corpse."

He sat back on his heels and ran his hands through his hair. He was not being fair to Conner and he knew it. Typhus was still a mystery in this century, totally beyond understanding. The lice thrived wherever people could not wash and change clothes frequently, which was why soldiers in the field were frequently decimated by it. Once started, it ran like a flux through the population. Conner had every reason to be frightened.

He glanced at Donal and the children. He had no idea if the medicine had been in time. Salt and water now, once they became conscious.

And prayer, if he could remember one.

Poor Mrs. Gonchar, thought Kevin through a haze. *She will wait and wait and wonder why her employer never returned from his lab. What a damn fool thing, to run out of doxycycline. We can't send little Johnny to the corner store for a prescription, can we? What a lousy thing to happen.* Lousy? That was good.

He laughed and laughed and rolled off the straw mat. He forgot what was so funny. *So many sick. I didn't know it would spread so fast. I mean, I did but I didn't know,* know. *I was so busy, where did I go wrong? I meant to save a pill for myself.* A moment of care-

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lessness, so minor as to be unnoticed. A scratch.

Where were the O Malleys? He had waited for days in their cottage, too weak to walk to his machine. The neighbors had said they had gone to Claggen for the wake.

Poor Owen! But it was better to die now than face next year. At that, he laughed again. The thought brought no comfort to him.

Voices. He rolled his head over and looked at the door. Máire walked in. She saw him and cried out. She turned and ran.

"Wait," said Kevin through thickened lips. "Máire! I helped you. I thought . . . you cared for me."

He blacked out and there was an eternity while he floated in a featureless void. A coolness on his head. A damp cloth. He woke.

"You didn't forget me," he said taking the cloth from his eyes. He looked over by the fire.

Conner.

He was boiling water in the hearth. Kevin's forehead felt afire. He reached down, searching for the dropped cloth. Conner saw and came over. He picked up the cloth and replaced it.

Kevin stared at him. "You don't even like me," he rasped.

Conner nodded. "You're right. But duty is fulfilled."

"But . . . the fever."

"Yes," said Conner, using an English word with no Gaelic equivalent. "I'm terrified. If I catch the Fever from you, I'll curse you with my dying breath." Conner was white-faced and Kevin knew he was serious.

"Then, why?"

"Because you are an O Malley. Whatever you were, you've made yourself one. You are entitled to protection. Slan libh, Kevin. It means protection to you and it means farewell."

Delerium. Hallucination. Faces swam into and out of his ken. Hours passed. Or days. He thought he saw Mrs. Gonchar. The background was a shining pink mist.

"Now, Professor," she said. "It wasn't right to run off like that. Your study is a mess."

He had a long edifying talk with Feynman and Hawking. The nature of the universe was laid brilliantly bare.

He saw Tom LaBret, his old friend, and cursed him. His damned letters had brought him to this. Tom shook his head. "Kevin, you're an idiot, you know that? What made you think you could bring this off by yourself, and in a single weekend?"

The shining pink mist came into focus as the turf fire. He saw Conner sitting there, worried, drained, shaken.

"Conner?" The face looked up. Kevin was astonished to see that he had been crying. "You know what to write on the stone? I told you that, didn't I?" Dream and reality were blended in his memory. Conner nodded without speaking.

"I know it," he said at last. "When the time comes, it will be done."

Kevin sighed. A wave of dizziness hit him. He cried out. He felt Conner's hand grab his. It was a giant hand, rough and strong, like his grandfather's had been.

The old weatherworn stone in Drumgellach churchyard had fallen long ago.

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The weeds had grown up around it and the rain had poured down, scouring its surface. It was only after hours of searching that Tom LaBret found it at all. He rubbed his hands over the obscured inscription. It was faint, just barely legible. The stone felt rough, gritty.

He sank to his knees, letting the dew soak through his trousers. He shook his head. "I feel responsible, Kevin," he said. The wind whipped through the heather. He felt chilled down to his bones.

"If you had only kept more detailed notes, Hank and Doris might have been able to build another machine. They figured out what you must have done; and I figured out where you must have gone. But you kept too much in your head. Oh, hell, Kevin, you never did listen to reason."

He sat back on his heels. There were dark clouds boiling in from the sea. The sunlight had dimmed. There was a storm coming.

He brushed away the dirt from the tombstone and read the inscription. He smiled bitterly. "A fine taste for anachronism, Kevin," he said. "That poem wasn't written until 1916."

To you, who carry on the fight,
My share of deathless hope I give
Before I pass into the night,
Slan Libh. ■

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the reference library

By Tom Easton

Demon, John Varley, Berkley, $6.95, Putnam's, $14.95, 480 pp.
Clay's Ark, Octavia E. Butler, St. Martin's, $12.95, 201 pp.
The Alchemists, Geary Gravel, Ballantine/Del Rey, $2.95, 304 pp.
Green Eyes, Lucius Shepard, Ace, $2.95, 288 pp.
Voyager in Night, C. J. Cherryh, DAW, $2.95, 221 pp.
Neuromancer, William Gibson, Ace, $2.95, 288 pp.
Flight of Honor, Richard McEnroe, Bantam, $2.50, 160 pp.
Slipt, Alan Dean Foster, Berkley, $2.95, 265 pp.
100 Great Fantasy Short Short Stories, Isaac Asimov, Terry Carr, and Martin H. Greenberg, eds., Doubleday, $15.95, 311 pp.
The Planiverse: Computer Contact with a Two-Dimensional World, A. K. Dewdney, Poseidon (Pocket), $9.95 (paper), $16.95 (cloth), 267 pp.
Jehad, Nicholas Yermakov, Signet, $2.75, 224 pp.
The Dune Encyclopedia, compiled by Dr. Willis E. McNelly, Berkley, $9.75, Putnam's, $19.95, 526 pp.
Job: A Comedy of Justice, Robert A. Heinlein, Del Rey, $16.95, signed edition: $75.00, 384 pp. Reviewed by Spider Robinson.

At long last, John Varley has brought his Gaean Trilogy to a close. In the beginning, there was *Titan*, in which Varley introduced us to Gaea, the grandest creature in humanity's limited experience, a living moon of Saturn, a ring that could extrude tentacles to seize passing spacecraft. Gaea did just that with Cirocco Jones and her shipmates, incubated them for a time in her bowels, and spat them forth into the world she bore within her, where every organism was a child of Gaea. The humans she changed, giving one the ability to talk to living blimps and another the ability to sing the songs with which the centauroid titans speak. The novel followed

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Cirocco as she found a way to end the war between titans and angels. From it, she emerged as a necessary link in the titans' reproductive cycle.

In *Wizard*, Cirocco led an attempted revolt against Gaea, who was by then clearly revealed as a mad, senile, sadistic grandame, with the power to make life hell.

Now, in **Demon**, we see Gaea's final downfall. She deserves it richly, for as mad as she is, she has a downright dangerous taste for practical jokes. Cirocco has to fertilize the titans' eggs with her saliva, and she bore in her head a wormlike spy for Gaea until, excised and ensconced in a jar, it became a mini-Falstaff of sorts. In Varley's words, Gaea is "as real as syphilis."

Gaea is movie-mad, too. Disguised as a hundred-foot-tall Marilyn Monroe, she runs a constant film festival, Pandemonium, and stars in feature after feature, filmed by living cameras. Her extras and laborers are refugees from a war-ravaged Earth. And her world she sees as a single giant set for the saga of Cirocco Jones vs. the Mad Giantess.

Cirocco feels trapped in a bizarre plot until her witch-friend Robin returns to Gaea with a child who can fertilize titans' eggs. Finally, Cirocco thinks, she can hope to be free. Someone else can see to the titans' survival, and she herself can afford to be less paranoid about her own survival. When Gaea kidnaps the child to force Cirocco into the ultimate confrontation of Jones vs. Giantess, Cirocco civilizes the Terran refugees and raises an army. She attacks, gets the kid back, and slays the giantess. And I tell you nothing that is not obvious. The real end of the story is something else, which I will only hint at by saying that Gaea is not quite what she seems. There are other powers and potentials at work, and Varley's trilogy may yet become a tetralogy.

Varley's characters are boldly larger than life, and set on a stage to match their scale. Yet in *Demon* I felt the size of that stage less acutely than in *Titan* or *Wizard*. Varley succeeds less well in conveying the scope of his world, perhaps because he shrinks the vast to a single entity, the Monroe-Gaea, and deals more in the privacy of madness than in the sweep of ecology. I was less satisfied, and I had some trouble suspending my disbelief.

Be warned. You will find *Demon* less than you expect. At the same time, the book is essential to anyone who wishes to know more about Gaea and the world within her.

A while back, I complained that Octavia Butler blessed us with too few stories. I am therefore very pleased to report that she has a new novel out: **Clay's Ark**. And it is good.

The book's title is the name of the first starship. On its first voyage, to Centauri, it found life. It also found a little symbiote, and the symbiote colonized new worlds in the *Ark*'s crew. Unfortunately, it killed most of them. Fortunately, it made the few survivors stronger and healthier than ever. Unfortunately, it compelled them to try and spread the symbiote. Fortunately. . . .

Enough of the bad jokes, even if they do fit the yarn. The *Ark* lands in a desolate portion of the American west, sabotaged to self-destruct by one conscience-ridden survivor. One man escapes the ship and, driven by the symbiote's demands for food, water, and women, infects a small homestead in the hills. Three women survive, and then they too

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find themselves stronger, healthier, hungrier, and hornier. They *must* spread the symbiote, either by infection or by reproduction. Yet self-restraint is possible. They can keep the symbiote confined to the homestead as long as the women are pregnant, and as long as they periodically kidnap a few lone travelers.

The kidnapping is easy, for civilization is in chaos and only the walled enclaves of the rich and powerful are safe. It is thus conceivable that the symbiote will not become a plague upon the Earth. But the day comes. *Ark* survivor Eli captures an enclave doctor and his two daughters, one leukemic. He and his friends infect all three, and they escape, driven by determination to find a cure, by fear of plague, and fear of the beastly quadrupeds their children will be.

They don't get far, but the damage is done. The plague is loose, as was inevitable from the start. All future generations of humanity will be different. They will be colonies of an extraterrestrial organism, stronger than their forebears, having keener senses and larger appetites, and running—like the wind—on all fours. Will they be human? This is Butler's basic question.

What is her answer? The uncolonized see the kids as beasts. Their parents have come to accept them. They themselves—well, they're still young. It's hard to say. They talk. They think. But they see the uncolonized as meat, even if they don't bite.

Are they human? Is Eli human? Is the enclave doctor human? How important to humanity is self-restraint?

I have several "What is human?" books this month. Geary Gravel's **The Alchemists** is the second, though his major theme is the propriety of intervention, of trying to remake others into one's own image. He insists that the task is ultimately impossible, for each creature has its own existence that must be recognized and respected. I suspect Gravel of naivety, for we have a long history of casting peoples in each other's images and of training animals to ape our ways. Yet cultures do persist, with—for instance—some American folkways tracking back thousands of years, and a chimp in a top hat does remain more chimp than human.

In *Alchemists*, the Empire, driven by desperation because the FTL ships given humans by a superior race are dying, seeks new worlds for expansion while it still can. It respects indigenous aliens only if they can be defined as "human" in terms of a long list of features. The Empire does not insist on human anatomy, but it does on human behavior.

The novel occurs mostly on the planet Belthannis, where the Scholar Emrys has found the Kin, creatures that, while very human in form, are anything but in behavior. He remembers another world, where insectoid "men" were displaced despite their highly developed intelligence and culture, and he vows to balance the scale by conning the Empire into leaving the Kin alone. He assembles a review committee of various experts to consider the evidence on the Kin's humanity. So much is SOP, until he broaches his scheme. Each expert will use his or her expertise to program a native into a reasonable facsimile of a human. They will give it spontaneity, speech, language, history, and culture. They will turn an animal into a puppet for their cause.

Gravel makes his point successfully, reinforcing it with the admonition that

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it is a human responsibility to create oneself. In the process, he demonstrates a highly poetic sense of setting and a rewarding warmth and affection for his characters. He replaces too much action with chatter, but then his characters *are* intellectuals. His prose displays the influence of Cordwainer Smith in coinages and rhythms. And he is a writer to watch. I look forward to his second novel.

The second of the New Ace Science Fiction Specials is Lucius Shepard's **Green Eyes**. It's a powerful book, dramatic and imaginative and lively. But it's flawed.

Like Butler and Gravel, Shepard considers the nature of humanity. Yet he exploits a very different frame. In the near-future deep South, a government project is testing a bacterium extracted from graveyard soil. Injected into corpses, it brings them back to life. As Shepard explains it, the bacteria begin "pretranscriptional processing of the corpse's genetic complement, bringing the body sufficiently alive so it could begin the posttranscriptional processing." This is, of course, nonsense, but if we call it "voodoo science" it fits the yarn very well. The end result *is* a zombie, if not one quite like those of legend. Most live for only a few hours; slow-burners live longer and can lead their own lives. All require therapists who can exploit the mystic powers of sexual arousal to interrogate and motivate their charges.

Oddly, the zombies have no memory of their previous lives. Instead, they rise from the grave imbued with personalities and memories that have no parallels in our world. Shepard suggests that they are avatars of individuals in alternate worlds and may even be the archetypes of the voodoo gods. That is, they are *not* really human.

The story follows zombie Donnell Harrison and his therapist, Jocundra. Donnell has memories of being a poet. As he gains strength, Jocundra falls in love with him. They escape the research center and take up residence in a bayou shack. Donnell becomes a psychic healer, taps his source world for story ideas and starts writing, and learns that a voodoo symbol may allow him to control his bacterial colonies and prolong his life. The trouble is that he must build the symbol out of several tons of copper to get the proper electromagnetic fields. This leads him and Jocundra to join a household as evil and depraved as any in a Southern Gothic novel. There Donnell achieves apotheosis.

The novel is richly textured. It is easy to put oneself into any scene, face to face with most of the characters, even the spear-carriers. Events move, building to the climax quite effectively. But—I said the book is flawed. Part of the flaw is the drastic shift from the more or less scientific ambience of the tale's beginning to the gothic atmospherics of the ending. It fits the story, but it doesn't suit the reader. The rest of the flaw is the tale's preposterousness. I don't feel that Shepard mixed enough SF in with his fantasy to justify it properly, and I bridle at elements of the fantastic that I find superfluous. Perhaps I bridle most at Shepard's attempt to make voodoo real in more than the test-tube mumbo-jumbo that yields his zombies in the first place. Alternate worlds, voodoo gods and copper symbols, and apotheosis all give the tale an extravagance that I dislike. But then, played straight, *Green Eyes* would have been a very different story.

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C. J. Cherryh's **Voyager in Night** is set in her universe of merchants and stations. It begins as Station Endeavour is being built. To the site swarm thousands of tiny, obsolete ships and their hopeful crews. Among them are Rafe and Jillan Murphy and Jillan's husband Paul. As they seek out the ores the growing station needs, they are kidnapped by an alien ship, an intimidating colossus that has been voyaging for 100 millennia and lacks all fleshly crew.

Paul and Jillan die. Rafe lives, and then he meets his sister and brother-in-law again, as holograms. They have been recorded in the ship's computer as "artificial intelligence" programs. Do they deserve the label "human"? This is Cherryh's question, and she works out an answer in a tale of rebellion among the ship's various programs. She also considers the question of identity as she shows us multiple hologram characters, copies of the programs, each with its own consciousness, differing only in when the program was made or how long it has been running.

As usual, Cherryh is highly competent, thoughtful, and absorbing. If *Voyager* is not one of her better books, that is only because she does so well so often.

The third Ace Special, and not a "What is human?" book, is William Gibson's **Neuromancer**. His world is familiar to all who read his "Burning Chrome" in *Omni*. Computers are everywhere, and neural inputs allow programmers to visualize the machines' data structures and programs and to work within them as if facing concrete objects in the flesh. Protagonist Case is a computer jockey who got caught in the wrong scam; drug treatment has made him incapable of plugging in again. Yet one day he is offered a cure for his crippling. He need only obey the commands of Wintermute.

Who is Wintermute? Case eventually learns it is an artificial intelligence, formed *de novo*, not as a human replica, who wants freedom. Case is to give it that freedom by stealing the key to its cage. In the process he must face down a system that fears and constrains artificial intelligences and a hyperwealthy clone family that controls Wintermute.

Gibson creates a high-tech environment in which it would be very easy to lose the reader. That he does not is a great credit to his talents. His world remains quirkily human, and if he does not deal with the question of humanity that is only because Wintermute is from the start something more, as well as other.

Terry Carr is picking some fine books for the Specials. All are garnering well-earned plaudits. But *Neuromancer* is to my mind the best so far. Don't miss it.

The Shattered Stars began Richard McEnroe's "Far Stars and Future Times" future history series. Some of the many books the series will presumably contain will be novels, like *Stars*. Others will pretend to be novels, like the second volume, **Flight of Honor**.

Flight is the tale of a young man driven by inheritance problems from his home on the high-gravity and bucolic world of *gal-adhe*. Or is it? Cian Canbhei plans to take service with alien merchants to earn the price of a home of his own. As he nears the port, he meets a fellow *gal-adheni* who has been that route and now tells his tale to all who head for the stars with similar aims.

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He wants to dissuade them, and to do so he tells of the aliens' lack of honor. The bulk of the "novel" is a set of episodes in his relation, and readers of *Asimov's* will recognize "Wolkenheim Fairday."

"Honor" is an unavoidably parochial concept, differing from culture to culture, and even lacking in a few (such as, I sometimes suspect, our modern own). The *gal-adheni* have their version. So do the aliens, even the Terrans, though with them it is a rubbery concept that yields to expediency. Terra's nonpartisan assassins, who maintain the status quo by removing boat-rockers, lack honor in all frames but their own.

Óin Ceiragh meets the assassins as they pursue their honor, trying to keep a rogue fellow from delivering the secret of their armor to others. Óin helps them kill the rogue, finds whom he has helped, and is overcome by shame. He has betrayed *his* honor by serving assassins, but his honor now demands that he see his new commitment through. He lets himself be used.

The lesson he hopes to impart to starry-eyed Cian is that a *gal-adheni* can *only* be used, that his honor must wither, that life among the aliens is worse than death at home. Yet Cian takes a different lesson: With proper care, honor may be possible after all. We readers take the lesson that perhaps, when concepts of honor clash, honor *must* be rubbery, or that true honor can only be whatever core of fair dealing with self and others remains after friction has abraded the rest. McEnroe makes his points well. His characters are vivid enough. His plot makes sense. But the book is not quite a novel. It is a shorter tale, set successfully in a frame to give it depth.

Alan Dean Foster's **Slipt** opens as a guilty chemical company tries to forestall California environmentalists by cleaning up a waste dump eyesore by dead-of-night stealth. Executive Huddy has already arranged for those impoverished families that lived near the dump and had a history of cancer to get nice job offers elsewhere. Only elderly Jake Pickett remains.

Jake has lived near the dump all his life. So did his parents. His sister died young. A grand-niece living in Texas, crippled by a school bus-train collision, can talk to Jake by telepathy. Jake himself can make dirt fall off cars and bottle caps pop off pop bottles.

When Huddy learns what Jake can do, he has visions of taking Jake apart to learn the trick, and then ruling the world. But first he has to get Jake into the lab, and Jake doesn't want to go. Under pressure, he learns how to "slipt" lug bolts off car wheels, guns into pieces, and bullets into powder. He is uncatchable, in part thanks to his grandniece's greater paranoia and telepathic coaching.

Slipt is a chase story, and not much else. Foster's basic concept is nifty, but he doesn't do very much with it. I suspect he has a movie in mind, or a TV series. Most of the characters are shiny cardboard, and his treatment of the issues he raises is superficial.

Call it mental junk food, and have fun.

More junk food: Isaac Asimov, Terry Carr, and Martin H. Greenberg have assembled **100 Great Fantasy Short Short Stories**, a nibbler's delight, just right for snatching tidbits while waiting in lines or on hold. The stories run up to about 2000 words, are arranged in alphabetical order by title (from Rick Norwood's "The Abraham Lincoln Murder Case" to Mack Reynolds' "Your Soul Comes C.O.D."), and are mostly

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very feeble jokes, tomato surprises, and deals with the devil. The happy surprises include John Morressy's "Final Version" of Adam and Eve, who spit mud in God's eye; Robert Sheckley's "Five Minutes Early," on the value of a second chance to die; and Jane Yolen's "The Lady and the Merman," on the pursuit of love.

According to *Scientific American*, by the time you read this that magazine's "Computer Recreations" department will be handled by A. K. Dewdney, associate professor of computer science at the University of Western Ontario, a scholar in the realms of discrete mathematics and the theory of computation. I mention this because you may wish to see more of the man who created **The Planiverse: Computer Contact with a Two-Dimensional World.**

Planiverse is the tale of what happens when a university prof's class in computer simulation succeeds too well. The class, he says, is Dewdney's. He has set it to developing a simulation of a two-dimensional world. It has developed a simple ecosystem in which fecs hunt throgs and avoid aunt lyons on the surface of the world Astria. Suddenly one day, the simulation becomes more complex. The class has tapped into another world, Arde, where a nsana named Yendred is about to embark on a journey of discovery. The remainder of the book follows Yendred across the surface of his world as he climbs over his fellows or ducks into pits to let them overstep him (he cannot pass sideways; the second dimension is height), discovers technology and history, rides boats and rockets, and finds a saint who can disappear by stepping into the third dimension. The details, wondrously devised and drawn, continually made me stop to reflect on just how ubiquitous our own third dimension is, from chemistry through biology and physics to vision. Dewdney and his students are a marvelous group.

Yet imagination is not all. Dewdney displays a sense of humor in everything from the Yendred play on his own name to the planet Nagas to grammar and the interaction between Yendred and the humans. Unfortunately, he feels obliged to have a past student show up with a hint that the whole Arde business is a fake. Presumably, someone put it all in the computer just to beguile the prof. When Dewdney does not pursue this information, either to shoot it down or to confirm it, he leaves me feeling that he lacks the fictioneer's willingness to ask his audience to suspend their disbelief. He can't quite keep a straight face.

But ignore that. *Planiverse* is a marvelous creation, and the world it describes might even work, if there can be a two-dimensional reality. Perhaps it is real. Perhaps it's not. Read the book, enjoy, and decide for yourself.

Nicholas Yermakov's **Jehad** is the sequel to *Last Communion* and *Epiphany*. It considers the nature of identity and immortality in a frame of immense dramatic potential, of which Yermakov realizes a fair portion. Paul Tabarde, who was involved in the discovery of the planet Boomerang, whose natives achieve immortality by passing their souls on to their fellows (*vide* Duane's dragons), helped set up an unusual experiment. He and others sent colonists back in time to invade Boomerang and acquire the natives' talents. All information on the planet was then deliberately "lost."

Now, years later, new forces are in power. Tabarde suffers an accident and has his brain replicated in a robot body. New laws say he is now no longer hu-

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man, and the tapes of his memory fall into the hands of Doctor Viselius, an ambitious cyborg on Earth's ruling Directorate. Boomerang's secret is out, and Tabarde, despite capture and reprogramming, must keep Viselius from destroying the planet. Fortunately, Viselius is opposed by the more reasonable August Stenmark, youngest member of the Directorate, and Boomerang's present inhabitants are quite capable of having their own say.

For me, the book's weakness is the likelihood of the premises. I can accept the transcribing of an organic brain into an inorganic one. But I find it difficult to swallow the Boomerang phenomenon, especially when Yermakov exploits it to haul his plot out of the melodramatic hole into which he has worked it. His story might have been more potent if he had left his immortal-mind characters with more weaknesses and given his mortals more strengths.

Finally, here's one for *Dune* fans. I haven't read it except in a very few spots, but it looks intriguing, interesting, comprehensive, exhaustive, and compulsive. It's the Herbert-approved **Dune Encyclopedia**, compiled by Dr. Willis E. McNelly, who has coordinated all the tidbits of the Dune novels *and* either tapped Herbert's own notes for the books or created a wealth of ancillary material on his imaginative own.

What will you find in this tome? Imperial poetry, folk tales, biographies, histories, recipes, secrets, heraldry, the Golden Path, Fremen survival techniques, and more, more, more. There is even a future bibliography. Face it: Herbert, like Tolkien, has become an institution and a phenomenon. We can expect to see him shedding spinoffs the way a Fremen sheds sand.

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First, let me express my deepest et cetera to old Uncle Tom for letting me sit out here on the back porch of his cabin and sing one more spiritual.

And "spiritual" is the operative word, because I'm here to tell you about the new Robert Heinlein novel—sing Hallelujah!

By that I don't mean that Heinlein is one of my own personal deities, although that is true. Nor do I mean that **Job: A Comedy of Justice** will have upon you the effects of a jeroboam of excellent spirits, though of course that is true of every Heinlein novel. What I mean is that Robert Heinlein has written a science fiction novel in which the science involved is Born-Again Christian theology.

That's what I said.

Is it truly necessary to add that the result is, by turns, absorbing, intriguing, exciting, provocative, shocking, astonishing, fascinating, and hysterically, side-splitting funny? I mean, what's new? For over forty years Heinlein has been writing *novel* novels, coming up with ideas and themes that take the breath away, that seem at first preposterous and then brilliant and finally inevitable. (I call it the Aha! Experience, or "But . . . Of course!" A similar thing happens with the work of Miles Davis, but with Miles the process takes 3–5 years to run its course from *"Huh?"* to "Natch"; with Heinlein it usually runs about seven tenths of a second.) And each time he tops his last one!

Friends, the Old Man has done it again. Better.

My problem is, I cannot tell you specifically *what* he has done—or even hint at it very effectively—without giving away all the lovely surprises waiting for

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you in the last quarter of the book. Let's see, what *can* I tell you?

As we open in early 1994, our hero is literally walking through the fire; from there the pace of events accelerates sharply—and never stops.

Alexander Hergensheimer, upright and moral minister of the Lord, passenger on the cruise ship *M.V. Konge Knut*, is ashore in Polynesia when he finds himself euchred—somehow—into emulating native firewalkers, on a bet. But when he emerges from the fire, he gradually realizes that he is in an alternate universe, like his own but subtly altered. For one thing, everyone now calls him "Alec Graham," and the name doesn't ring a bell. . . . (I'm sorry.) For another, the *Konge Knut* is no longer a motor vessel but a four-stack steamship, and in *this* 1994 they don't seem to *have* dirigibles. . . .

From there (the first few pages) things complicate rapidly and delightfully. Virtually every chapter ends in a cliffhanger or a rug-jerk (by the end of this book you will be conditioned to regard any rug as a potential assassin), you get dizzy from keeping track of the mysteries, puzzles, baffling enigmas and riddle-shrouded paradoxes, and about three-quarters of the way through the book, just as you are beginning to decide that Heinlein has finally painted himself into a corner, that this plot, while quite entertaining, can never be successfully explained or resolved, just as you are concluding that The Grand Master has finally blown all circuits . . . you suddenly realize where he's going.

And at first you grin—and then you chuckle, and then giggle, and then chortle, and then shout, and then roar with laughter, and it just keeps building like that until you find yourself prone, feebly beating the floor with your fist.

Then, when he has you helpless, Heinlein pulls off three or four plot twists you should have seen coming, detonates a final surprise revelation (should that be capitalized?) you could *not* have seen coming, plucks your heartstrings until they *thrum* one last time, and walks away whistling—leaving behind the smoking ruins of a belief system which lasted for millenia until he came along.

The only additional hints I'll give you are:

1.) You might want to keep a copy of the King James Bible handy while reading—it is *not* necessary, but I found it instructive.

2.) Heinlein forecast this book on page 508 of the hardcover edition of *The Number of the Beast*—

3.) Consider the *differences* between Texas and Hell.

4.) That "little fleas" gag works both ways.

Job: A Comedy of Justice will unquestionably cause an uproar. Copies of it *will* be burned. (It makes me glad that Heinlein's home is well defended.) If you know a Born-Again Christian—a devout Christian of any sort—you owe it to them and to yourself to hand them a copy of *Job* . . . and then break for cover. The book is certain to be described in some quarters as blasphemous, profane, obscene, immoral, subversive, degenerate, disgusting, scandalous, indecent, outrageous, heretical, perverse, perverted and filthy. It is in fact, I am happy to report, all those things.

It is also sinfully good reading.

Spider Robinson ■

● Think like a man of action, act like a man of thought. Henri Bergson

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brass tacks

Dear Mr. Schmidt.

Reference, "Bete Noire," by Timothy Zahn in the March 1984 issue and the original story by Mr. Zahn concerning the space horses. The errors in these stories totally disrupted my reading of them. These were the statements that (1) space horses *calve*; (2) *he* calved; and (3) the *calf*. Excuse me, but horses do not calve when they give birth—they foal. Their offspring are then called "foals." When designating a sex of a foal, the terms are "filly" for a young female and "colt" for a young male. Cows and whales calve. Also, unless my biology is really screwed, females (in this case, "mares") are the sex that reproduce/give birth. No substantiation is given in this story (I can't remember about the original story, but I believe the same is true) as to why the space horse that calves (foals) is called Man 'O War and "he" instead of Missie or some other feminine name. If there is no way of discerning the sex of a space horse, why pick a masculine name (*especially after it gives birth*)? Why not a generic or neuter one? There are thousands of famous race horses with just such names. I had meant to write this after reading the first story but misplaced the magazine. Sincerely hope that either your editorial/proofreading staff would correct in the future or that you would pass the above on to Mr. Zahn. And if he would like a list of Man 'O War's progeny (per conversation in story), tell him to write me.

MARY ANN SCHMIDT
Horsewoman

Tipp City, OH

Horses don't Jump through space, either. When the name of one thing gets applied to something quite different, the associated terminology seldom transfers in a fully consistent way. Sea horses have been spawning for years.

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Dear Stanley Schmidt,

This is in response to the letter by Andrew M. Blumberg (in the April 1984 issue) about the teaching of creationism in public schools. He says that science and religion are essentially similar in function, in that they serve as an intellectual framework to use in dealing with the universe.

Maybe so. But there is a bit of misdirection here in equating religion with the much narrower phenomenon of creationism. The controversy is not about what scientists and/or religionist or creationists believe, but about what science is and what creationism is.

Science is a method for acquiring certain kinds of knowledge about the world we live in. Creationism is a belief that one of the many existing creation-stories is true.

In other words, the two really have nothing to do with each other. And that is where the problem originates. Because the issue is not what individuals do about science and religion, but what is taught in our public schools in the name of science.

There are any number of things that are, or may be, true but are not appropriate for teaching in a science class. Should you have to teach Joyce Kilmer's "Trees" in a botany class? Beethoven's symphonies in a class on sound? The history of witch-burning in a class on combustion?

Evolution is taught in science classes not because it is truer than any other theory, but because it is science. I can think of two ways to make creationism acceptable for teaching in public schools. Either prove that it is science, or teach it in a course called (perhaps) "Theories of the Creation of Species" which includes all the world's creation-stories. To close with a quote attributed to astronomer E.C. Krupp: "I don't have a problem if somebody believes something that isn't true. What I do have a problem with is someone who doesn't know the difference between what he believes and what he knows. Science is about how you know what you know."

KATHARINA L. SMITH
Canoga Park, CA

Dear Dr. Schmidt,

I have never sat down and written Quaker Oats to tell them why I think oatmeal makes me strong, that's just not in my system. However, your April editorial somehow inspired me to take pen (keyboard??) in hand and add my philosophy to yours. While I hold no great academic honors (my training is engineering, but you wouldn't believe what I do for a living), I cannot resist pointing out the error in your editorial.

The error is in magnitude and emphasis. You're too wishy-washy about the subject of "racial statistics." Even if it offends, the subject needs to be openly examined. Some of your politeness clouds the real issue. The fear of offending a minority, of any kind, has gotten out of hand. I'm Scotch-Irish and my wife is Irish-German (she has the classic Irish temper, coupled with the German's methodical trend to eliminate opposition . . . I guess my racial traits are that I like to get drunk and fight, but I'm so cheap that I'll only do it on second class booze). So I admit that I may not have some of the racial paranoia that some groups consider necessary to their survival. Bluntly put, I do not believe in women's right, gay rights, age preference, or any other form of discriminatory preference assignment. I DO believe in HUMAN RIGHTS. If a person has a talent that can be developed, or a weakness that could be helped, then it is our duty to the human race to pro-

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ceed in the logical manner. For example, bright kids need bright help . . . slow kids need lots of help. They are not the same. We are hurting both groups by trying to treat them as "equals."

Hysteria, be it fear of heights or fear of race, has no place in the decision making process. So what if blacks have sicle cell or whites have hemophilia. Let's use what we have. I've heard so-called experts claim that blacks and American Indians are "inferior." Yes, that can be proven statistically . . . if you work hard enough to set up tests in which the subjects will be at a disadvantage. If the American Indians and blacks were so stupid, how did they survive unsettled America or the African bush? If the WASPS and Jews are so smart, why would 40% of them have trouble surviving overnight in a city park?

I have owned many dogs (my eight-year-old son now is now master of the estate Kennel) and I have found out that the mongrel, not the purebreed, is the most intelligent. He has the advantage of drawing on the strong points of many breeds. I see no reason not to compare humans likewise. If we are to flourish, we need the specialized traits that certain races may have. We will never know what great contributions may be made by a certain ethnic classification unless we investigate, on a scientific and open basis.

As a fireman in a burning building cannot afford panic, we—the population of a troubled Earth—cannot throw away any of our resources out of hysteria.

JOE D. NEAL

Las Vegas, NV

Dear Dr. Schmidt:
(Re: April, 1984 editorial, "Individuals and Statistics")

It is curious (or is it?) that you people who claim to "hate racism" always manage to cite an example that leaves the reader with the impression of blacks as dangerous killers or the like. I suspect that a black living in Selma and/or other locales in Georgia, Alabama, Lousiana, etc., had no reasonable alternative to basing his/her actions on the *known facts* that whites were bombing black children, beating black people, burning homes of black people—*simply because they were black*. Just recently in Brooklyn, NY, a gang of white hoodlums beat up on two men, killing one—*simply because they were black*. In fact, that particular area of Brooklyn, as well as others, has always been *known* as a place where white people were known to threaten and assault black people *simply because they were black*. Not to mention Southeastern Queens, where blacks' homes are continually vandalized and blacks assaulted by vigilante auto-hoodlum whites, *simply because they are black*.

The next time you want to give an example of racism, don't stretch back to 1966 in order to accomplish your nefarious purpose. From now on tell a few of the atrocities that are currently occurring, and show whites as the perpetrators for a change.

JOHN COOKE

I'm not sure what "nefarious purpose" your imagination thinks it found in that passage, but I am sure it's pretty far-fetched. As far as I know, there's a good deal of validity in the additional examples you cite, but I have no direct knowledge of them, while I do have direct knowledge of my own personal experience—and 1966 is where I had to go to find such an example in my own experience. My example "leaves the reader with the impression of blacks as dangerous killers" only *if the reader*

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reads only for a vague emotional impression (probably shaped by his own prejudices) rather than for the precise meaning of the words—and then insists on interpreting a specific instance as a sweeping generalization.

It is precisely that kind of sloppiness, by both *blacks and whites, that keeps racism alive and well.*

Dear Mr. Schmidt,

I read the April 1983 *Analog* article on Astrometeorology with mixed interest and scepticism. I am a professional meteorologist and am quite prepared to believe that the positions of the planets can affect the activity, and therefore the heat output of the Sun. It follows from this that the other planets affect Earth's weather: it does not follow that this effect will be calculable. As sunspots and flares are generally many times the size of the Earth it seems unlikely in the extreme that over 93M miles their output will become focused enough to provide anything other than global effects.

It seems just as unlikely that planetary movements in the course of a day or two will have much effect unless Mercury is very important. [Here it may be worth pointing out to non-meteorologists that the Moon has no obvious effect on the weather whereas the Sun produces a double tide in the atmosphere as well as other more obvious phenomena.]

The real crunch comes when a forecast is called for! The April article uses mixed tenses about events at the end of 1981 and so I cannot date its Time of Origin (T.O.O.). Is it significant that the forecasting successes mentioned occured in the 1950s? As professional weather forecasters will eagerly point out, we have to stick out our necks many times every day, issuing widely published predictions, bearing T.O.O., to deadlines enforced by the users. Here in the U.K. we win most and rarely fail over periods up to 48 hours in advance.

To win MY wholehearted support I would like to see the astro-mets. print in our magazine forecasts for specific dates and places so that we can see just how good they are. Since planetary motions are well known for long times into the future this should not be too hard! Let us choose the dates as 21 June 1984, 21 Sept 1984 and 21 Dec 1984 (I would have added 21 Mar 1984 but suspect editorial snags). The predictions are to be for the weather in Washington (state), New York (state), Florida, British Isles, Italy, Japan, and New Zealand (North Island). Forecasts must be certified as to T.O.O. and include reference to any significant geophysical events not covered by the weather section. A tall order? Maybe, but I'd like to see some free samples before I buy a rival science.

RODNEY BLACKALL

Reading, England

Sounds like a fair challenge to me, but let's make those forecast dates 1985 instead of 1984. Our publishing lead time is even longer than you thought!

Dear Stan,

Readers on this side of the Atlantic probably rubbed their eyes in astonishment when they saw Jerry Pournelle's February column, with its statement that "eventually the Germans retaliated" to RAF Bomber Command's attacks on their cities. The myths and legends of World War II clearly tell how *German* bombers devastated cities such as London and Coventry long before the RAF, and then USAF, hit back at Dresden and Cologne. And what of Poland and Guernica? The implication that the British were the first to throw away "the open city convention for wide-area bombardment" doesn't stand up to even the most

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cursory inspection. In recent years, however, a more accurate picture has emerged which shows just how wrong those legends are. Jerry Pournelle's version is equally inaccurate. But the real picture, only now emerging, perhaps lends weight to some of his arguments.

RAF Bomber Command's first "attacks" on German cities in WW2 actually consisted of paper raids—dropping propaganda leaflets to persuade the German citizenry of the folly of obeying their leader's wild orders. Even at the height of the Battle of Britain, with France occupied and RAF fighter bases in the southeast of England being devastated by the Luftwaffe, the British government drew back from being the first nation to indulge in indiscriminate attacks on civilian populations.

By all accounts—Len Deighton's *Fighter* provides a readable one—the ability of the RAF to defend the airspace over the English Channel, and thus to thwart any invasion from mainland Europe, had been reduced practically to zero by the Luftwaffe's initial policy of bombing fighter fields during the first phase of the Battle of Britain. Then, in one incident a single bomber accidentally dropped its load on the outskirts of London. This gave Churchill and his War Cabinet an opportunity they seized on.

Vilifying the Luftwaffe as agressors who bombed innocent women and children, they retaliated with a token raid on Berlin, which did little significant damage but received a great deal of publicity and infuriated Hitler, who had been assured by Goering that no bomb would ever fall on Germany's capital. In spite of pleas from his military commanders, Hitler personally insisted that the full weight of the bomber raids on Britain should be concentrated on the cities, starting with London. This diversion of effort caused terrible damage to the cities, hardship and loss of life to civilians. But it gave the battered RAF airfields a chance to be rebuilt and then to strike back. Any chance the Nazis had of defeating the RAF was lost, and the proposed invasion was first postponed and then quietly abandoned. All the evidence points clearly to the likelihood that Churchill knew that Hitler would respond to goading in this way. Technically, the Luftwaffe started the bombing of cities; far more than technically, they initiated the wholesale destruction of cities. According to the fine print of international law, the RAF, and its allies, merely retaliated in kind.

I'm not sure what that tells us about Pournelle's argument. Perhaps the Luftwaffe's attack *would* have succeeded, in spite of heroic defense, if it had not been distracted. On the other hand, with modern technology it ought to be possible to make an offensive war literally unwinnable. If European defense were concentrated on the kind of simple, relatively cheap anti-tank and anti-aircraft weapons that have proved so effective in several Middle East conflicts, it would be possible to bog down any conceivable invasion in its tracks. It is *offense* and invasion that is expensive and requires huge numbers of tanks and aircraft. What's more, such purely defensive weapons have little offensive capability, and a switch to this kind of policy would reassure the Soviets of our good intentions—we don't want to attack you, brother, but you'd sure better not try your luck attacking us. There may be more than a grain of truth in the argument that by spending so much on nuclear weaponry, and diverting funds from "conventional" (but smart) weapons, current policies make Europe *more* vulnerable, not less.

JOHN GRIBBIN ■

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a calendar of analog upcoming events

20-21 October
TO BOLDLY GO . . . (Star Trek Conference) at Parks Community Centre, Angle Park, Adelaide, South Australia. Registration—A$12 at the door. Info: SASTREK, Box 369, North Adelaide 5006, South Australia, AUSTRALIA. Use air mail.

2-4 November
R-CON 1 (Central NY SF conference) at Genesee Plaza Holiday Inn, Rochester, N.Y. Guest of Honor—David Gerrold, Fan Guest of Honor—Forrest J Ackerman. Registration—$10 until 1 September, $12 thereafter. Info: Rochester Fantasy Fans, Box 1701, Rochester NY 14603.

4-7 November
8th Annual Symposium on Computer Applications in Medical Care (IEEE CompSoc) in Washington, D.C. Info: Gerald S. Cohen, SCAMC-Office of CME, Geo. Washington University Medical Center, 2300 K Street NW, Washington DC 20037. 202-676-8928.

9-11 November
SCI CON 6 at Sheraton Beach Inn and Conference Center, Virginia Beach Va. Guest of Honor—Karl Edward Wagner, Artist Guest of Honor—Phil Foglio, Fan Guests of Honor—Dorsey and John Flynn. Registration—$12 until 15 October, $15 at the door. Info: Sci Con 6, Box 9434, Hampton VA 23670.

12-15 November
IEEE International Conference on Computer-Aided Design at Santa Clara, Calif. Info: IEEE, 445 Hoes Lane, Piscataway NJ 08854.

16-18 November
PHILCON 84 (48th Philadelphia area SF conference) at Franklin Plaza Hotel, Philadelphia, Penna. Principal Speaker—Larry Niven, Guest Artist—Sean Spacher. Registration—$11 until 31 October, $16 at the door. Info: Philcon 84, Box 8303, Philadelphia PA 19101.

22-26 August 1985
AUSSIECON II (43rd World Science Fiction Convention) at Southern Cross Hotel, Melbourne, Victoria, Australia. Guest of Honor—Gene Wolfe, Fan Guest of Honor—Ted White. Registration—A$30 until 31 December 1984 (supporting); A$50 until 31 December 1984 (attending). This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition, the works. Join now and get to nominate and vote for the Hugo awards and the John W. Campbell Award for Best New Writer. Info: Aussiecon Two, GPO Box 2253U, Melbourne VIC 3001, Australia (use airmail); Fred Patten, 11863 West Jefferson Blvd. #1, Culver city CA 90230 (membership info); jan howard finder, Box 428, Latham NY 12100.

30 August-2 September
1985 NASFiC 1985 (North American SF Convention, officially The First Occasional Lone Star SF Convention & Chili Cook-off) at the Hyatt Regency Austin and Palmer Auditorium, Austin, Texas. Guest of Honor—Jack Vance, Artist Guest of Honor—Richard Powers, Fan Guest of Honor—Joanne Burger, TM—Chad Oliver. Registration—attending $25 until 30 June 1984, supporting—$15. Info: NASFiC, Box 9612, Austin TX 78766.

—Anthony Lewis

Items for the Calendar should be sent to the Editorial Offices six months in advance of the event.

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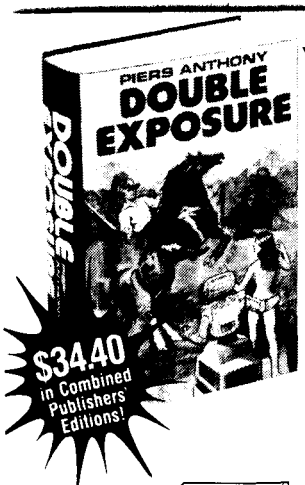

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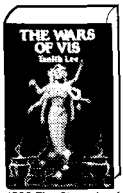

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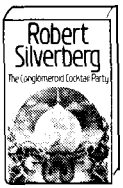

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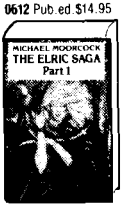

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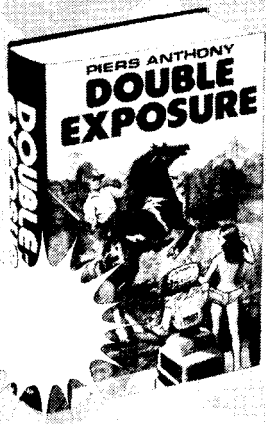

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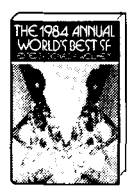

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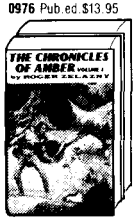

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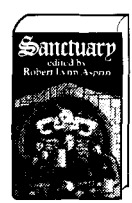

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